

EG&G ROCKY FLATS

OPERATING UNIT # 2

SITE HEALTH AND SAFETY PLAN

AUGUST 19, 1991



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AUGUST 19, 1991
(Revision 1)

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1.0 INTRODUCTION

This plan establishes requirements and provides guidelines for worker safety and hazard identification during the operation of the **Granular Activated Carbon Treatment System for the Operable Unit No. 2 (OU2)** located at the Rocky Flats Plant in Golden, Colorado. The purpose of this plan is to identify procedures for avoiding potential hazards from chemicals, equipment, or the environment, and for responding to serious injury or accident. No changes will be made to this plan without consent and approval by RES Project Manager and Health & Safety Officer. These changes to be filed on HSP Field Change Forms in appendix A.

1.1 SITE DESCRIPTION

The OU2 is comprised of the 903 Pad, Mound, and East Trenches Areas which are located east-southeast of the RFP as shown in Figure 1. The areas of OU2 lie within either the South Walnut Creek or Woman Creek drainage basins. Twenty sites, designated as IHSSs, lie within OU2: five in the 903 Pad area, four in the Mound area, and 11 in the East Trenches area.

The 903 Pad Area consists of the following IHSS sites:

- 1) 903 Drum Storage Site (#112) - Area used (during the 1950's and 1960's) for storage of drums containing cutting oils containing the following:

- | | |
|------------------------|-------------------|
| - Uranium | - Mineral Oil |
| - Carbon Tetrachloride | - Trichloroethene |
| - Tetrachloroethene | - Silicone Oils |
| - Acetone | - Ethanolamine |

These drums were removed by 1968; the contaminated areas (resulting from leaking drums) were scraped into one area and capped with dirt and asphalt.

- 2) 903 Lip Site (#155) - Area contaminated by wind carried contaminants from the pad area.
- 3) Trench T-2 Site (#109) - Trenches used for disposal of sanitary sewage sludge and flattened uranium and plutonium contaminated drums.
- 4) Reactive Metal Destruction Site (#140) - Area previously used for destruction of lithium, sodium, calcium and magnesium metals and various organic solvents.
- 5) Gas Detoxification Site (#183) - Building 952 - used to detoxify bottled gases.

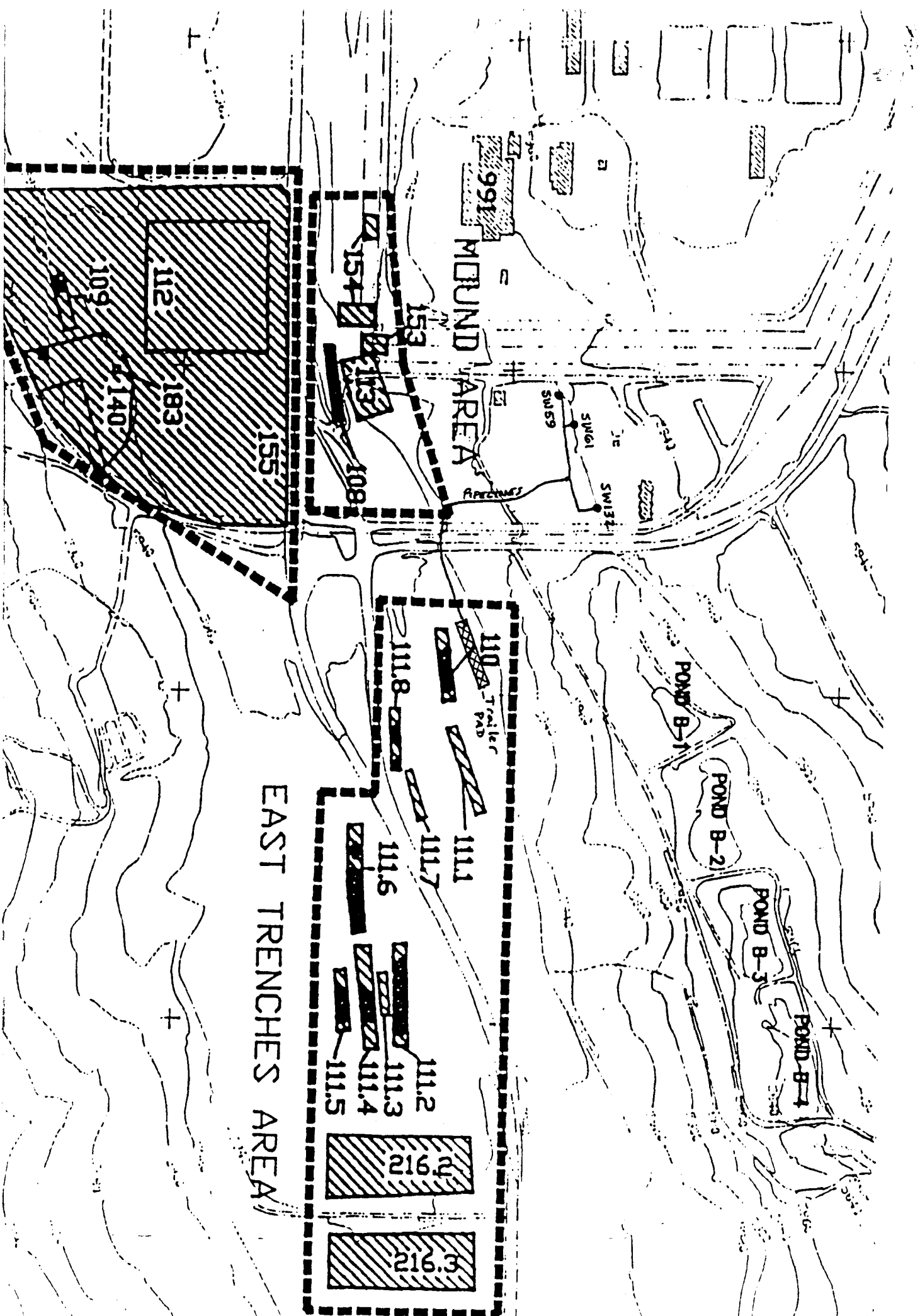


FIGURE 1 - IHSS LOCATIONS

The Mound Area consists of the following IHSS sites:

- 1) Mound Site (#113) - Uranium, plutonium and solvent drum storage area. Area has been partially remediated.
- 2) Trench T-1 Site (#108) - Trench containing approximately 125 buried drums of depleted uranium and plutonium chips coated with lathe coolant.
- 3) Oil Burn Pit No. 2 Site (#153) - 2 trenches previously used for burning oil containing uranium.
- 4) Pallet Burn Site (#154) - Area used to burn pallets which might have been contaminated with solvent and/or radionuclides.

The East Trenches Area consists of 9 trenches which were previously used to dispose of depleted uranium, flattened depleted uranium and plutonium-contaminated drums and sanitary sludge. These may be found in figure 1 as follows:

Trench T-3	#110
Trench T-4	#111.1
Trench T-5	#111.2
Trench T-6	#111.3
Trench T-7	#111.4
Trench T-8	#111.5
Trench T-9	#111.6
Trench T-10	#111.7
Trench T-11	#111.8

Additionally, two (2) areas (#216.2 and #216.3) were used for spray irrigation of sewage treatment plant effluent.

Also present in the vicinity of the **OU2** are six (6) other IHSS previously designated as Solid Waste Management Units (SWMU) (see Figure 1):

- 1) IHSS 121 Original Process Waste Lines - These are abandoned process effluent from the process areas at the facility. Potential groundwater contaminants are tetrachloroethylene, trichloroethylene, carbon tetrachloride, radionuclides, and nitrates.
- 2) IHSS 141 Sludge Dispersal Plume - This area is believed to have been impacted by wind dispersion of dried sludge from the Sewage Treatment Plant drying beds.
- 3) IHSS 142.5 Retention Pond B-1 - This pond was believed to have been contaminated by various wastes containing nitrates and low level radioactive waste.

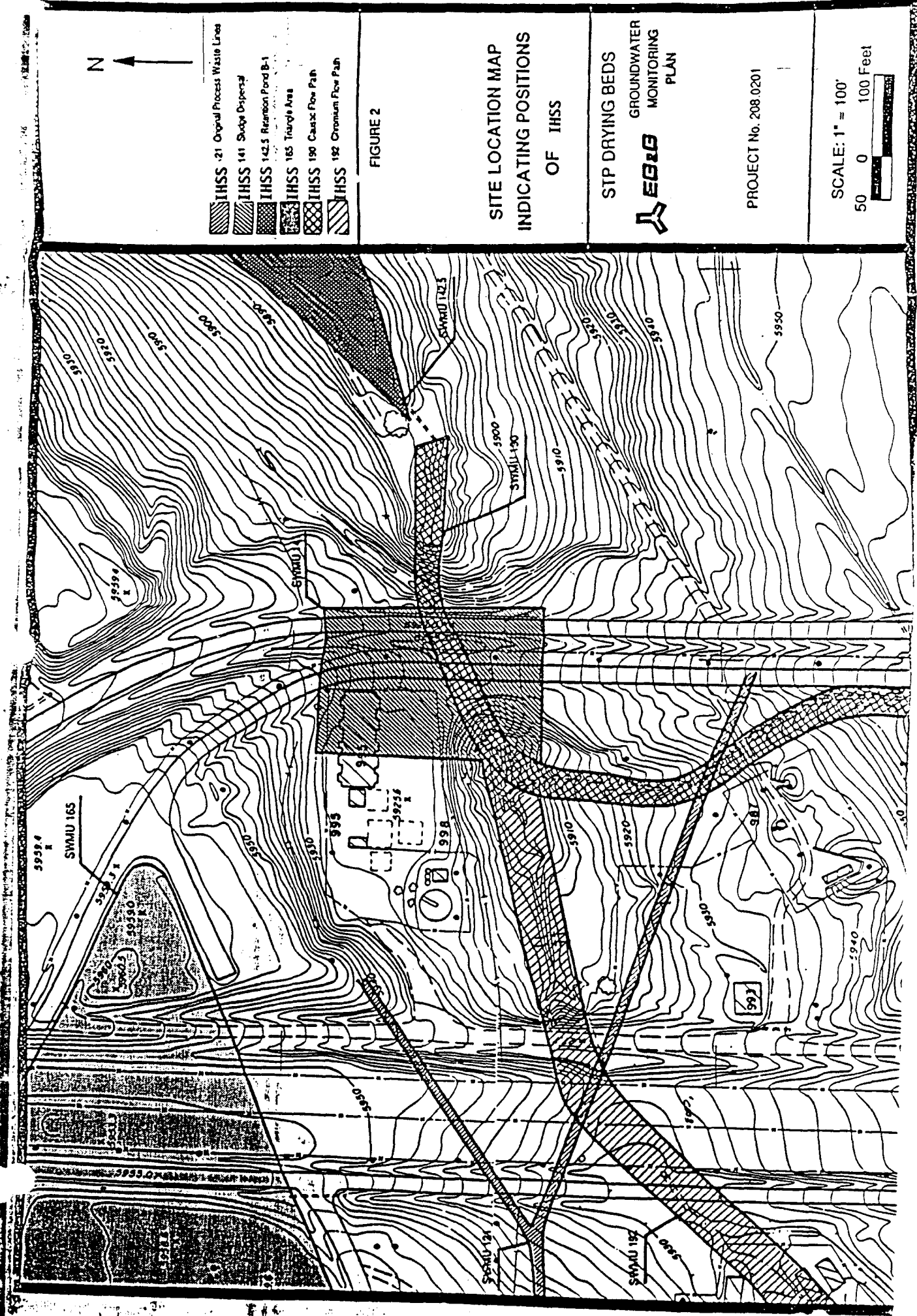


FIGURE 2 - IHSS LOCATIONS (PREVIOUSLY SWMU)

- 4) IHSS 165 Triangle Area - This area was used from 1966 to 1975 for the storage of drums containing plutonium contaminated wastes. These wastes have since been removed.
- 5) IHSS 190 Caustic Flow Path - This area was caused by a spill of caustic wastes near the steam plant (building 443). Snowmelt is believed to have transported potassium hydroxide (which had been neutralized) to Pond B-1.
- 6) IHSS 192 Chromium Flow Path - This area was caused by the transport of cooling-tower blowdown, which may have contained chromium-laden biocides, to Pond B-1.

Chemical Data Sheets for the various contaminants present may be found in Appendix C.

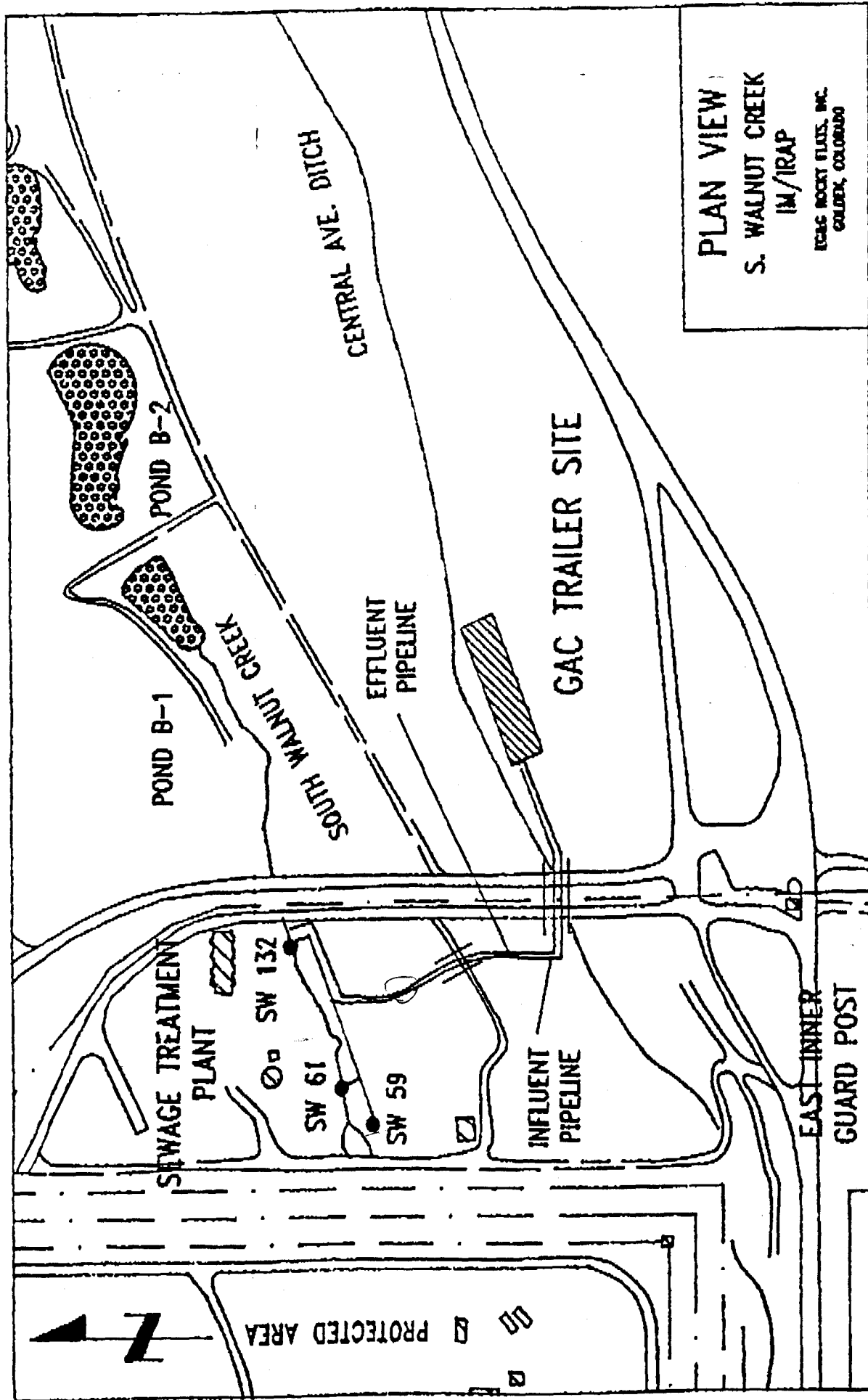


FIGURE 3 - GAC TREATMENT SYSTEM LOCATION

2.0 SCOPE OF WORK

As part of the Interim Remedial Action Plan for the **Operable Unit Number 2**, RES designed, build and set up at Rocky Flats a water filtration system which includes the following:

- 1) *Collection System* - catch basins in the field to collect water and pump it to a 10,000 process storage tank,
- 2) *Process System* - three bag filters and four granular activated carbon (GAC) units to filter water of assorted hydrocarbons and chlorohydrocarbons,
- 3) *Trailer* - housing for process system and office,
- 4) *Electrical System* - support for alarms, process system, collection system, air conditioner, heater, and trailer.

These were fabricated during the months of April and May, 1991 and installed on May 11, 1991. The start up date was May 13, 1991. (see figure 3 for location and layout).

3.0 KEY PERSONNEL ASSIGNMENTS

3.1 EG&G PERSONNEL

<u>NAME</u>	<u>TITLE</u>	<u>EXTENSION</u>
J.E. Evered	E. R. Director	4934
T.C. Greengard	Remediation Programs Manager	7121
D.W. Pontius	IRA Manager	5536
D. Smith	E. R. H&S Officer	5958
J.R. Majestic	H&S Director, Deputy AGM	4707
F.J. Furman	Occupational Health Director	2895
C.E. Kennedy	Manager, Safety & Hygiene	4369
G. Shearer	H&S Area Manager	2755
D.M. Sassong	H&S Liaison Officer	5785
L.A. Doerr	Radiation Engineering Rep.	5151
B.P. Fielding	Site H&S Coordinator	7098

3.2 RES PERSONNEL

<u>NAME</u>	<u>TITLE</u>
Dave McClellan	Project Manager
Frank Sesler	H&S Officer
David McClellan	Project Engineer
Mike Obel	Operator
Mark Caylor	Operator

The Project Manager has overall responsibility for implementation of the Site Health and Safety Program.

The Health & Safety Officer is responsible for application of the Site Health and Safety Plan to each task.

The Project Engineer is responsible for the design, modification, and operation of the treatment system.

The Project Operators will be responsible for on-site personnel assignments and task completion.

4.0 ON-SITE WORKPLANS

The following tasks were completed on RFP site for the installation of the OU2 system. These tasks will overlapped, somewhat, but the sequence was similar to the following:

1. Each weir was installed without excavation (see QA Addendum). A steel box cover was bolted to the tops of each weir to protect and contain the weir. A stainless steel submersible pump is placed (free standing) inside.
2. The primary influent piping was connected by using insert fittings. This pipe is inserted into the secondary pipe, which is also connected using insert fittings. All secondary piping is connected to the primary using rubber reducing fittings (except at the collection weirs). The system was periodically be pressure checked for leakage. The discharge pipeline is constructed of schedule 80 PVC and pressure checked. Routing through the culvert required cribbing with short lengths of channel stock placed laterally across the culvert to raise the pipelines from the bottom.
3. The pipelines were heat traced, insulated, and covered with an aluminum skin secured by screws. The insulated piping is supported above the ground with timber cribbing and anchored with tee posts.
4. The surge tank was placed inside the containment tank and plumbed together. The tank is centered on the pad and anchored in accordance with Rocky Flats Plant Standard SC-106, Rev. E for Important-Low Hazard Seismic Loading.
5. The trailer was delivered and centered on a pad built by EG&G. The long and short sides of the trailer were leveled independently, using 4 foot carpenters levels. Cables are connected from the trailer to the tie downs provided by EG&G; these were tightened in accordance with Rocky Flats Plant Standard SC-106, Rev. E for Important-Low Hazard Seismic Loading.
6. The portable generator was placed near the trailer and connected to its fuel supply (a 1000 gallon double wall steel fuel tank).
7. The trailer was plumbed to the surge tank. The collection and discharge pipelines are plumbed to the surge tank and their respective submersible pumps.
8. The weirs, and all remaining piping were heat traced, insulated and jacketed.
9. The electrician wired the collection pumps, and heat tracing to the trailer's breaker panel. The breaker panel was then wired to the generator.
10. Final system inspection and check.
11. Acceptance test.

The following outlines the tasks and procedures required for the safe and efficient operation of the OU2 GAC system:

I. Collection System

A. Operation

1. The submersible pumps in each weir are controlled automatically from the control panel. In the event of an emergency, the pumps may be shut down manually at the control panel.
2. The liquid level in the surge tank is controlled by adjusting process system discharge rates. The tank system is protected from overflow through automatic high level alarms and collection pump shutdown. Additionally, the process pump is protected from running dry by low level alarms and shutdowns.

B. Maintenance

1. The collection system will be routinely inspected and audited per the QA Addendum.
2. All equipment will be maintained per manufacturers recommendations (see OU2 system Operation and Maintenance Manual).
3. All repair or maintenance will be recorded in the operators logbook.

II. Process System (General)

A. Operation

1. The system flow will be controlled manually. Gate valves will control flow rates. Ball valves will control direction through the system.
2. The system will be protected by over pressurization by pressure relief valves and rupture disks. The system will be protected from vacuum by vacuum breakers in the discharge line.

B. Maintenance

1. The system may be drained as required through an in-line diaphragm pump; this pump will also be used to transfer to the surge tank any substantial spillage around the system or accumulations in the containment tank.

2. All equipment will be maintained per manufacturers recommendations (see OU2 system Operation and Maintenance Manual).
3. All repair or maintenance will be recorded in the operators logbook.

III. Particulate Filter Vessels

A. Operation

1. Double length bag filters are utilized in the filter vessels.
2. The differential pressure and flowrates will be observed and recorded at least hourly (as specified in the QA Addendum).
3. Filter changes will be performed when 30 psig differential pressure is reached across the filters (as indicated on the inlet and outlet pressure gauges, inlet - outlet = differential pressure). During higher flowrates, this differential pressure may not be readily achievable so filter changes will be required when flowrates drop below the minimum allowable rate.
 - a. Filter change will require that the vessel be isolated from the system by closing the inlet and outlet valves.
 - b. The vessel may be drained by opening the bottom drain valve and activating the diaphragm pump.
 - c. The vent valve (on top) will be opened to allow air into the vessel to displace the water being drained.
 - d. After checking the vessel pressure, the vessel may be opened by loosening the lid retaining swing bolts.
 - e. The filter may be removed; any residual liquids may be poured into a nearby open top drum (to be transferred to the surge tank with the diaphragm pump) and placed in a drum for later sampling and disposal.
 - f. A new filter may be placed in the support basket in the vessel.
 - g. The lid may be secured with the swing bolts.
 - h. The vessel must be filled to purge all air from the system by closing the bottom drain valve and opening the inlet valve leaving the vent valve open until the vessel is full of water.
 - i. Opening the outlet valve will place the vessel in service.

B. Maintenance

1. The equipment will be routinely inspected per the QA Addendum.
2. Maintenance of these vessels will be per manufacturers recommendations.
3. All repair or maintenance will be recorded in the operators logbook.

IV. GAC Units

A. Operation

1. GAC vessels are installed in the trailer by securing the base to the floor with the custom anchorage built in to the decking and connecting the inlet and outlet to their respective ports in the system utilizing quick connect hoses.
2. The unit will be pre-wetted per manufacturers recommended methods (described in the OU2 Unit Operation and Maintenance Manual).
3. The units are operated in series, with one lead vessel and one polish vessel; these vessels will remain in these positions until contaminant breakthrough occurs.
4. When the lead vessel no longer reduces the contaminants to required levels (breakthrough), the lead vessel will be bypassed and a new configuration will be utilized: the existing polish vessel will become the new lead vessel, and a fresh vessel will become the polish vessel. This may be accomplished by simply opening and closing a series of valves (4 vessels will always be on-line and ready for use).
5. As very fine material accumulates on the carbon beds, the differential pressure across the vessel will increase, resulting in drop in flowrates. When adequate flowrates cannot be maintained, one or both vessels may require backwashing.
6. Backwashing may be performed by the following steps:
 - a. The system is accelerated to reduce the volume in the tank to minimum levels (during backwash, no water will be allowed to discharge; collected water will accumulate).
 - b. The system must be valved to return the treated water to the tank by opening the final return valve and closing the main discharge valve.
 - c. The discharge totalizer reading should be noted to assure no water escapes untreated during this operation.

- d. High efficiency particulate filters will be loaded in the filter vessels (these will remove all particulate matter from the backwash product as it circulates from the vessels to the tank and back to the vessels).
- e. The lead vessel will be bypassed so water is flowing initially through the polish vessel.
- f. The treated water is directed to the lead vessel's outlet and out the vessel's inlet to be returned to the tank. This will create a backflow in the vessel and flush any particulate accumulations off the carbon bed.
- h. Backwash will continue until the return stream visibly clears (as noted in the clear pipe section on the return line).
- i. The operation may be concluded by reversing the above steps. The discharge totalizer should be noted prior to resuming discharge.

B. Maintenance

- 1. The vessels will be routinely inspected per the QA Addendum.
- 2. The units will be maintained per manufacturers recommendations.
- 3. All repair or maintenance will be recorded in the operators logbook.
- 4. All maintenance will be recorded on a maintenance check sheet.

V. Generator

A. Operation

- 1. The portable generator will be utilized until an alternative electrical source has been installed by EG&G.
- 2. Fuel will be supplied by an independent fuel service.
- 3. Care will be taken during refueling operations to minimize any spillage. All spillage will be immediately contained and removed. Significant spillage will be immediately reported to EG&G.

B. Maintenance

1. The generator will be inspected daily for proper lubricants, oil, belt tension, etc.
2. The generator will be maintained per manufacturers recommendations.
3. All repair or maintenance will be recorded in the operators logbook.

VI. SAMPLING

A. Water

1. Water samples will be collected per EG&G Standard Operating Procedures - Surface Water 4.0.
2. Sample containers will be new and certified free of contaminants (IChem).
3. Sample frequency will be defined by EG&G, and will be sufficient to indicate carbon unit breakthrough in a timely manner.
4. Documentation of sampling episodes will be in accordance with the QA Addendum.

B. Waste

1. Particulate filters and carbon will be sampled for analysis prior to use to establish background levels of contaminants.
2. All waste will be sampled prior to disposal.

5.0 HAZARD EVALUATION

Operation and maintenance of the OU2 GAC system will present the following potential hazards:

- 1) *Physio-chemical* - Various organic contaminants (see Table 1) exist in the water at SW59 and SW61 in low concentration; it is anticipated that these contaminants will not pose a respiratory threat to workers, however, precautions will be taken to avoid physical contact with these waters.
- 2) *Biological Hazards* - Bee sting and snakebite may pose a threat to workers on this site.

TABLE 1
SURFACE WATER QUALITY

	<u>UNITS</u>	<u>INFLUENT</u>	<u>EFFLUENT</u>
<u>Organics</u>		<u>CONCENTRATION</u>	
Vinyl Chloride	ug/l	11	NA
Methylene Chloride	ug/l	34	NA
Acetone	ug/l	99	NA
Carbon Disulfide	ug/l	5	5U
1,1-Dichloroethene	ug/l	127	5U
1,1-Dichloroethane	ug/l	6	5U
1,2-Dichloroethene	ug/l	10	5U
Carbon Tetrachloride	ug/l	249	5U
Trichloroethene	ug/l	298	5U
Tetrachloroethene	ug/l	235	5U
<u>Dissolved Metals</u>			
Antimony	mg/l	0.0607	NA
Beryllium	mg/l	0.0052	NA
Iron	mg/l	0.3476	NA
Manganese	mg/l	0.6073	NA
Selenium	mg/l	0.0063	NA
Strontium	mg/l	0.8772	NA
Tin	mg/l	0.7641	NA
<u>Total Metals</u>			
Aluminum	mg/l	24.0745	NA
Antimony	mg/l	0.645	NA
Barium	mg/l	1.5985	NA
Beryllium	mg/l	0.0439	NA
Cadmium	mg/l	0.0120	NA
Chromium	mg/l	0.1642	NA
Cobalt	mg/l	0.1105	NA
Copper	mg/l	0.2281	NA
Iron	mg/l	155.5478	NA
Lead	mg/l	0.1664	NA
Lithium	mg/l	0.5859	NA
Manganese	mg/l	2.8410	NA
Mercury	mg/l	0.0019	NA
Molybdenum	mg/l	0.1426	NA
Nickel	mg/l	0.1922	NA
Selenium	mg/l	0.0078	NA
Strontium	mg/l	0.9081	NA
Tin	mg/l	0.1941	NA
Vanadium	mg/l	0.4244	NA
Zinc	mg/l	1.3159	NA

TABLE 1 (cont.)
SURFACE WATER QUALITY

	UNITS	INFLUENT CONCENTRATION	EFFLUENT
<u>Dissolved Radionuclides</u>			
Gross Alpha	pCi/l	17.70	NA
Gross Beta	pCi/l	33.86	NA
Plutonium 239/240	pCi/l	0.17	NA
Total Uranium	pCi/l	10.17	NA
<u>Total Radionuclides</u>			
Gross Alpha	pCi/l	632	NA
Gross Beta	pCi/l	463	NA
Plutonium 239/240	pCi/l	7.34	NA
Americium 241	pCi/l	2.96	NA
Total Uranium	pCi/l	13.21	NA

The influent concentrations are based on flow-weighted maximum concentrations of 903 Pad and Lip Area Seeps (SW-50, -51, -52, -55, -57, -58, and -77), SW-53, -59, -63, -64 and Upper South Walnut Creek seeps and surface water stations (SW-56, -60, -61, -101).

The effluent concentration requirements are based upon Applicable or Relevant and Appropriate Requirements (ARARs). The "U" designation following the effluent concentrations indicates that the concentration is the detection limit for that constituent.

- 3) *Radiological* - Low level may be present in surrounding areas (25 pCi/gm Alpha and 36 pCi/gm Beta have been detected in the soils in the area) and in the water at SW59 and SW61(Table 1); the immediate site will be sampled by EG&G prior to work to ensure that significant levels of radionuclides are not present.
- 4) *Maintenance* - typical hazards will include electrical shock, vehicular hazards, crane, and typical hand tool hazards.

5.1 SITE SPECIFIC HAZARDS

1. Low Level Radiation

This project does not involve handling of significantly high levels of radioactive material, but the potential to encounter radioactive materials exists from currently unknown sources. Any suspect material (i.e. does not belong to RES) should be treated with the likelihood of containing radioactive material and should not be handled without written authorization from EG&G. Additionally, any restricted areas should not be entered for any reason without proper authorization from EG&G. These restricted areas will be posted with proper labeling and barricaded. Items which display yellow media are to be considered containing radioactive materials and should not be handled by RES personnel. EG&G will provide TLD Badges for Riedels' personnel to be analyzed monthly as required by EG&G protocol. Riedel employee's will sign a statement for EG&G to release results of TLD Badges to Riedel. In addition EG&G personnel will make a daily sweep of the area for low level radiation during installation.

2. IHSS/SWMU

This phase of RES operations is not within IHSS areas. No SWMUs comprise the selected trailer site, but the collection stations will be placed on a SWMU area; the soil in this area will not be removed. RES personnel is directed not to enter or disturb soil within IHSS/SWMU boundaries.

3. Noise

Elevated noise levels may be encountered during filter changes from the purging of air from the vessels. A noise survey was conducted by RES Health & Safety Officer when the operation began to determine the need for hearing protectors. All levels were below the 85 decibel range, but there may be a need for hearing protection if conditions change or further construction is conducted. Control of noise hazards shall be in accordance with 29 CFR 1910.95. Noise hazard areas (greater than 85 decibel average continuous, or 140 decibel impulse) must be appropriately marked and hearing protection for noise attenuation worn when in the area.

4. Electrical Shock

Electricity is provided for operations by EG&G. The filtration system will be properly grounded, with outlets protected with ground fault interrupters. All electrical cords will be rated for the task involved, and will be inspected prior to use to insure good working condition.

5. Vehicles

On site speed limits have been established at 5 mph. Site characteristics has developed numerous short visibility areas, blind spots and a need to reduce dust disturbance (IHSS/SWMU) which requires slow speeds. Seat belts will be worn by all workers in vehicles.

6. Granular Activated Carbon (GAC)

GAC preferentially removes oxygen from air. Warning signs will be provided to indicate the potential for a low-oxygen area. Warning signs will also be provided indicating that the access doors to the trailer remain open while servicing the GAC units.

7. Heat - Ambient Air

During summer months temperatures will range from 70°F to 95°F. Crews will maintain proper fluid intake, break in shady areas, and observe each other for signs of heat stress. Hazards and symptoms of heat stress will be discussed in tailgate safety meetings when necessary.

8. Cold

During winter months temperatures could range from 40°F and below. Crews will watch each other for signs of cold stress. Warm fluids and frequent breaks may be deemed necessary. Hazards and symptoms of cold stress will be discussed in tailgate safety meetings when necessary.

9. Rain

Spring and Summer rains will make for slick surfaces and an increase in volumes of water to treat.

10. Snow

Winter snows will make for slick surfaces, reduced visibility and possible ground blizzard.

11. Electric Storms

During electric storms crews will remain indoors or in a vehicle until it passes. All equipment shall be properly secured and grounded.

12. Lifting/Moving

Proper techniques for lifting shall be used when changing filters. Mechanical devices shall be used whenever possible.

13. Rough Terrain

Rocky Flats Plant is located near the foothills so terrain has hills, valleys, slopes, ditches etc. Crews shall pay attention while on foot or off road in a vehicle.

14. Structural Integrity

The trailer should be an enclosed, self contained unit, stable and will be anchored in accordance with Rocky Flats Low Importance Seismic Criterion and for high wind stability.

15. Remote Area

Areas of Rocky Flats Plant are isolated and have poor visibility. Crews will have a portable phone or radio contact with one another and with RFP Emergency Response (966-2911).

16. Heavy Equipment

Some heavy equipment will be used to move the trailer and plow roads. All equipment shall have roll cages and seat belts. Back up alarms shall be on all pieces of equipment.

17. Materials Handling

All materials shall remain in original containers if possible. Proper storage and usage shall be followed.

18. Storage Flammable Gas/Liquid

Diesel fuel shall remain in proper D.O.T. approved container or in fuel tank on Riedel pickup or in properly grounded double wall storage tank. All other fuels will be stored in approved safety cans in approved locations.

19. HazMat Use/Corrosives

Acids used to treat samples shall remain in original container and handled using safe work practices as discussed in RES 29 CFR 1910.120 training for hazardous waste site worker awareness. Nitrile or Neoprene gloves will be worn when handling corrosives. MSDS's will be provided on-site for all chemical products supplied or used on-site by RES.

20. Hand Tools

Hand tools will be inspected weekly and before each use for wear, jagged edges, split or broken handles and removed from service if defects are found. All manufacturers procedures shall be followed.

21. Power Hand Tools

Power tools shall be inspected weekly and before each use. Any defects the tool is to be pulled from service and tagged for repairs. All manufacture's procedures shall be followed.

22. High Pressure Water

Water will be flowing through pipe and hose at maximum 50 psi. Connections and clamps are to be inspected daily. Spare fittings and hoses will be kept on site should there be a rupture. Additionally, the system will be equipped with pressure controls and relief (and backup pressure relief) to protect against over pressurization. All exterior piping is doubly contained; all interior piping is contained in a buried area; the equalization tank is contained in a secondary tank. Should a problem arise, any spillage will be contained within the secondary piping, tank or within the containment berm; the spillage will be directed to the tank for treatment for discharge.

23. Wind

Rocky Flats being along the front range catches numerous days of high winds. All equipment, trailers, and pumps shall be anchored as not to be effected by the wind. In excessive wind employees shall remain in an anchored trailer or vehicle. During construction, winds in excess of 15 mph the job will shut down.

24. Confined Space Entry

Installation and inspection of the pipelines within the culvert under the buffer zone access road will require entry. All procedures will closely follow and comply with RES' and EG&G's confined space entry program (See Appendix B).

25. Lift Equipment

Installation and modifications of the system will require use of a small crane to off load and locate equipment.

26. Ladders

Ladders may be used periodically to inspect the tank and trailer. The ladder will be secured at top and bottom for slide out and safety harnesses with lifelines attached to the top of the tank will be used when working on the tank.

5.2 ENGINEERING CONTROLS

The engineering controls built into the water treatment system to minimize risk of exposure include:

1. Closed system from weirs to discharge
2. Pressure relief valve to shunt excess water to storage tank at pressure in excess of 12 psig.
3. Air auto-release valve for each GAC unit.
4. Cleanup pump on floor under GAC units.
5. Heat, ventilation and air-conditioning unit in the trailer.
6. PVC piping to withstand pressure in excess of 100 psi.

7. Visual and audible alarm system for overflow or low volume.
8. Backflush and drain GAC units immediately with water prior to removal.
9. All water will be returned to the equalization tank for treatment for discharge.

A portable deluge shower wash is installed in the inside front of the trailer. Workers will be instructed to remove clothing immediately and flush any body part that comes in contact with the contaminated water. The shower is a pressure vessel with built in eye wash and drench hose. It will contain solution and be pressurized to not over 90 PSI.

5.3 SAFE WORK PRACTICES

Safe work practices by workers to minimize risk of exposure to contaminants include:

1. Familiarity with hazards, symptoms of exposure and first aid for chemical contaminants present in filtration water, via on-site training.
2. Wear PPE of PVC boots, saranex suit, nitrile gloves and face splash protection when performing work expected to encounter contaminated water such as sampling, filter changes, system repair/maintenance.

Although contact with contaminated water is not anticipated, workers will be informed of the hazards of the contaminants in compliance with 29 CFR 1910.1200 and 1910.120. MSDS' will be kept on site as Appendix C to this site safety plan.

6.0 GENERAL TRAINING

All personnel who work on this site have completed 40 hours of classroom training in handling hazardous waste (O.S.H.A. 1910.120). This training includes:

Regulatory Compliance	Toxicology
Flammables	Corrosives and Reactives
Respiratory Protection	Protective Clothing
Noise Stress	Heat/Cold Stress
Ionizing Radiation	Drum Handling
Confined Space	Decontamination
Environmental Monitoring	Site Safety Plans
Medical Surveillance	Contingency Plans

The classroom training is followed by three days of on-the-job training, supervised by experienced personnel. Annually all field employees receive eight hours of refresher training on the above topics.

Additionally, all on-site personnel involved with the operation of the system will complete a radiation worker training provided by EG&G.

Managers and supervisors receive eight hours of training on safe management of hazardous sites. All training complies with 29 CFR 1910.120. All RES field employees receive initial and recertification training in First Aid and CPR. Site specific training for this project includes a 24 hour class put on by EG&G in Radiation Safety and operations.

6.1 TRAINING FOR SITE SPECIFIC HAZARDS

All employees who are subject to exposure to the organics, dissolved metals and total metals of the filtered water shall be informed of the following:

1. Specific nature of the operations which could result in exposure to contaminants.
2. The purpose, proper selection, fitting, use and limitations of protective equipment applicable to work with contaminated water.
3. A description of the medical surveillance program to evaluate for effects of exposure.
4. Information concerning the symptoms and adverse health effects associated with exposure to the contaminants.
5. Routes of exposure (skin penetration, inhalation, and ingestion).
6. First Aid for exposure to the contaminants.

6.2 TAILGATE SAFETY MEETINGS

Job site tailgate safety meetings shall be conducted by the RES health and safety officer or the shift foreman at the beginning of each shift for each job and whenever new employees arrive at the job site. The meetings discuss the Health and Safety considerations for that day's activities and outline the protective equipment necessary. Minutes of the meetings will be maintained. Weekly safety meetings will be conducted by the Project Manager with the aid of one crew member from each shift discussing a site specific topic of concern.

7.0 SITE CONTROL

Access to the site will be controlled by Riedel with assistance from the EG&G security staff. Only qualified individuals may enter the site and perform work on the project, and will require understanding of this Site Safety Plan (as indicated by signature on the safety plan). The site is visible from the inner east gate and proper signs will designate areas for safe entry.

Zones will be established as defined by the tasks and PPE requirements outlined in section 8.0 of this plan; details regarding locations of these zones will be discussed in the toolbox safety meeting prior to work requiring regulated zone establishment. The zones will include an exclusion zone, contamination reduction zone and support zone designated by differing colored banner guard.

8.0 PERSONNEL PROTECTIVE EQUIPMENT

At all times, all workers on site will wear steel-toe shoes and hard hats. When performing tasks presenting a risk for exposure to contaminants, workers will wear modified level "D" protection (SEE Table 2). This will include:

- Hard Hats
- Steel-Toe PVC Shoes
- Shatter resistant eye goggles or face shield
- Nitrile Gloves
- Saranex Suit

No changes to the specified levels of protection shall be made without the approval of the site safety offices and/or the project manager.

Contaminated protective equipment shall not be removed from the regulated area until it has been decontaminated or properly secured for decontamination elsewhere.

Legible and understandable precautionary labels shall be affixed prominently to containers of contaminated scrap, debris, waste water and clothing prior to storage on site.

No food or beverage shall be present or consumed in the designated regulated zones. Eating or drinking shall be allowed only in designated areas and only after hand and exposed skin has been washed.

No tobacco products shall be present or used in regulated zones. Cosmetics shall not be applied in the regulated zones.

All work on the project will be conducted according to the "Buddy" system.

MEDICAL SURVEILLANCE INFORMATION SHEET

EMPLOYEE NAME _____

TITLE _____

SSN _____

Operable Unit _____

Phase _____

Describe the employee's duties as they relate to the exposures at the ER remedial project site:

Detail the estimated exposure levels anticipated for this employee at this ER remedial project site:

Describe the Personal Protective Equipment (PPE) that this employee is anticipated using at this ER remedial project site:

FIGURE A-3 Medical Surveillance Information Sheet

HAZARDOUS MATERIAL ACCESS LOG

Date

Operable Unit Number

Phase Number

List the hazardous materials present in the work area and the concentrations (if available):

Names of employees entering area	Time of each entry	Time of each exit	Enter the coded numbers from below	
			Work Activities Performed	Personal Protective Equipment Used

WORK ACTIVITIES

1. Soil sampling, placing dirt in containers.
2. Augering, drilling, radiologic measurements
3. Walking across, standing on or near contaminated areas.
4. Examining excavations
5. Water sampling
6. Monitoring removal of contaminated material
7. Other:
8. Other:
9. Other:

PROTECTIVE EQUIPMENT

- A-1: Safety Boots, A-2: Outer Boot Coverings
 B-1: Permeable Coveralls, B-2: Non-Permeable Coveralls
 C-1: Disposable Gloves, C-2: Reusable Gloves
 D-1: Safety Glasses/Goggles, D-2: Face Shield
 E-1: Half-Face Respirator, E-2: Full-Face Respirator
 F: List type of air-purifying cartridge used
 G: Self-Contained Breathing Apparatus (PD or PP)
 H: Supplied Air (PD or PP)
 I. Other:
 J. Other:

FIGURE A-4 Hazardous Material Access Log

9.0 MEDICAL RESPONSE

This is a statement of procedures to be followed in the event of a medical emergency at the site. The plan is divided into several separate procedures depending on the severity of the injury. It is the responsibility of the Project Manager to judge the severity of injuries and take appropriate action. Basic first aid will be administered by RES personnel as necessary until medical assistance is available. All RES personnel are trained in American Red Cross First Aid and CPR. A first aid kit will be kept in the office part of the trailer.

Emergency Accidents

Immediately call for EG&G Response at 966-2911 and give details of emergency, and exact location.

Non-emergency Accidents Requiring Medical Attention

Anyone involved in an accident resulting in injury requiring non-emergency medical assistance (i.e., minor cut, sprains, etc.) will be sent to:

Hospital Name: Arvada Emergency Clinic

Address: 5730 Ward Road, Arvada, Colorado

Phone: (303) 422-8090

Directions:

From east gate at Rocky Flats, go right on Indiana and proceed south to 64th Ave. Turn left, and go to Ward road. Turn right on Ward Rd. and go south to 57th Ave. Turn left into clinic.

9.1 RECORD KEEPING

The Health and Safety Liaison Officer or SHSC shall retain a copy of the completed Figure A-3 for each employee in the Confidential Employee Training and Medical Certification File at the ER remedial project work site.

The Occupational Safety Division will maintain the completed figure A-4 along with the exposure data gathered during area sampling and personnel monitoring.

These records must be accessible to the employee for review.

9.2 MEDICAL SURVEILLANCE

Pre-employment and periodic update medical examinations are required for persons working with, or those who may be assigned to work with hazardous waste. The medical examination must have been within a 12-month period prior to on-site activity and repeated annually. Physical examinations are conducted for RES workers by Tridem Medical Services in Denver, Colorado. A fitness for duty statement for each worker will be kept on site. A description of the RES Medical Monitoring Plan is on file in the RES office and on site in trailer.

10.0 DECONTAMINATION

Workers having contact with the contaminated water (via sampling raw and contaminated water or system maintenance or accidental exposure) will decontaminate themselves in the deluge shower at the trailer. Workers will wash their hands with water following each sampling. Following an accidental exposure to the skin, workers will flush their skin with water for fifteen minutes. Following an accidental exposure to the eyes, workers will flush their eyes for fifteen minutes with water. The RES Project Manager will evaluate the circumstances and extent of any exposure for reporting to EG&G H/S Manager.

All PPE shall be collected, segregated and properly disposed of. Disposal shall meet all Federal, State, and DOE policies.

Tools and equipment shall be properly "deconned" and inspected before removal from site.

11.0 COMMUNICATION

The small work area and close proximity of workers will allow face to face communication among workers. A phone will be located in the office part of the trailer for communication in emergencies.

If necessary, two way radios will be incorporated where employees are outside a line of site from each other.

General hazard areas (i.e. hardhat, eye protection, etc.) will be properly identified and marked with signs advising of danger or exposure potential.

The on-site emergency phone number is 966-2911. This will activate the fire department and security to any situation.

All D.O.E. and Rocky Flats emergency procedures shall be followed.

<u>Alarm</u>	<u>Device/sound pattern</u>	<u>Action to be taken</u>
Evacuation	Boat Hailer/1 long	Evacuate the controlled area or move to an area of safe refuge until evacuation can be completed
Take Cover	Boat Hailer/2 short	Move to an area of safe refuge until "ALL CLEAR" is sounded

11.1 SITE SAFETY EQUIPMENT

FIRST AID KITS

<u>TYPE</u>	<u>LOCATION</u>
50 Item Standard	Trailer
10 Item Standard	Vehicles

Note: All first aid kits shall be approved in accordance with 29 CFR 1910.151.

FIRE EXTINGUISHERS

<u>TYPE</u>	<u>LOCATION</u>
10 # A, B, C	Trailer
2 1/2 # A, B, C	Vehicles

EYEWASH/DELUGE SHOWER/HANDWASH STATION

<u>TYPE</u>	<u>LOCATION</u>
15 Gallon Portable Eyewash/Shower	Trailer

PERSONAL PROTECTIVE EQUIPMENT

<u>TYPE</u>	<u>AMOUNT</u>
*Hardhat	3 EA
Saranex	1 CS
*PVC Boots	4 PR
Nitrile Gloves	2 DOZ
Duct Tape	4 ROLL
Splash Shield	2 EA
*Ear Plugs	50 PR
*Safety Glasses	6 PR

Note: These items (*) are issued to RES personnel, and RES will provide additional supplies to employees as necessary; amounts indicated are in addition to these issued.

12.0 MONITORING

EG&G will provide badges for all RES personnel. RES employees will authorize results of the badges to be released to EG&G and RES. During the construction phase a daily sweep of the area will be conducted by EG&G. An air monitoring station will also be near the area (operated by EG&G) to check for airborne contamination.

Ultimately RES personnel will begin to do their own monitoring upon completion of EG&G Rad safety and operation classes.

RES will make regular observations of the wind direction using such visual indicators as wind flag. To avoid inadvertent exposure to harmful dusts, employees will be warned to remain upwind of all work areas whenever possible. Work will shut down if wind speeds exceed 15 mph. Dust suppression by means of spraying the soil with water may be necessary when visible dust is present.

When working in or around confined spaces continuous monitoring with LEL, and O₂ meters shall be used as generally required by RES Class A & B confined space entry. In addition a Rad sweep shall also be conducted to assure worker safety. Copies of RES confined space procedures are in the Appendix A of this plan.

During GAC unit service, RES will leave access doors to the trailer to allow adequate ventilation.

I certify that I have read and understand this Health and Safety Plan for the operation of the OU2 Treatment System:

[illegible]

PRINT NAME

SIGNATURE

COMPANY

DATE _____

[illegible][illegible][illegible][illegible]

APPENDIX A

HSP FIELD CHANGE FORM

HSP FIELD CHANGE

Field Change Number: _____

Date Effective: _____

- *Pen and Ink* changes to be made in the HSP to alert the reader of this change:

- Reason for the change to be incorporated into the HSP:

- Text of Change to be Incorporated:

HSP FIELD CHANGE

Field Change Number: _____

Date Effective: _____

Review and Approval Signatures:

ER Health and Safety Officer

/ _____
Date

ER Program Manager

/ _____
Date

Director - Environmental Restoration

/ _____
Date

Health and Safety Liaison Officer

/ _____
Date

Occupational Safety Manager

/ _____
Date

Director - Health and Safety

/ _____
Date

ROCKY FLATS PLANT
Environmental Restoration
Health and Safety Program Plan

APPENDIX B

RES CONFINED SPACE ENTRY PROCEDURE

(REVISION 5)

RIEDEL ENVIRONMENTAL TECHNOLOGIES, INC.
CONFINED SPACE ENTRY PROCEDURE

April 4, 1991

(Rev. 6)

This procedure will be followed by all Riedel personnel entering a confined space for any work task. Strict adherence with this procedure is necessary to prevent serious injury or death. Failure to follow this procedure will be considered a serious violation of Riedel safety policy and will result in disciplinary action.

This procedure is based on guidelines contained in the NIOSH criteria document "Working in Confined Spaces" published December 1979 and meets or exceeds current Federal and State safety regulations.

All personnel entering a space must be thoroughly trained in this procedure. Special emphasis must be placed on ensuring that personnel can perform rescue operations efficiently.

I. RET POLICY

- A. No person, under any circumstances, will enter a space containing an explosive or oxygen enriched atmosphere; or one which has been deliberately inerted (less than 16 % oxygen by volume) for the purpose of making it safe for hot work, temporary entry repair, or other associated reasons.
- B. Decisions to enter a space deemed IDLH (referring to a toxic gas or vapor) will be made in conjunction with the Regional Safety Manager/Safety professional. As a general rule, policy will be to avoid entry in these conditions. When required, any entry to IDLH, or possible IDLH, will also wear Level B. Note that an IDLH atmosphere does not necessarily offer the same immediate hazard as oxygen deficient or explosive atmospheres (refer to I A above).
- C. Any person or persons entering a space of unknown hazard will wear a supplied air respirator and retrieval equipment and will be backed up by a rescue person dressed to a similar level of protection.
- D. All entries into spaces with unknown hazards will be supervised by a Riedel manager completely familiar with this procedure. This manager will be responsible for enforcing all the provisions contained in this procedure.
- E. No matches, lighters, or any other items capable of producing a spark or flame are allowed in any confined space with a potentially flammable atmosphere. Non-

approved radios, flashlights, or lanterns shall not be used in or within 25 feet of a confined space containing/potentially containing flammable vapors or gases.

- F. All procedures will be discussed with all involved personnel prior to the entry.
- G. Any deviations from this procedure will require the approval of the Regional Safety Manager.
- H. Training
 - 1. Every person who may work in confined spaces or be tasked with providing support for confined space jobs shall have training in the hazards and correct procedures before initial entry into confined space.
 - 2. Training shall consist of the following topics:
 - a. Respirator training
 - b. Confined space hazard recognition
 - c. Use of ventilation equipment
 - d. Atmospheric sampling and testing devices
 - e. Use of all rescue and support equipment
 - f. Emergency rescue procedures-practice
 - g. Lock out, tag-out procedures
 - h. Required personal protective equipment
 - i. Communication system
 - j. CPR/First Aid
 - k. Explanation of the RET Confined Space Procedure
 - l. Explanation of contingency plan

II. DEFINITIONS

A. Atmosphere:

Generic term for gases, vapors, mists, fumes, and dusts within a confined space.

B. Atmosphere Testing/Air Monitoring

The use of a combustible gas/oxygen meter, and/or a gas specific instrument to monitor the atmosphere inside a confined space. This definition includes the previous RET policy on instruments that:

- 1. All instruments are to be calibrated or span checked prior to use.

2. Any monitoring will be performed by personnel familiar with equipment operation.
3. Daily span check records will be maintained in the permanent job file.

C. Confined Space

A confined space is one with one or more of the following traits: limited openings for entry and exit; limited natural ventilation; toxic or oxygen deficient atmospheres; and/or areas that are not designed for continuous occupancy. Examples are: storage tanks, underground sumps, pipelines, pits, trenches, tunnels, ship holds, etc.

D. Confined Space Class A

A confined space that presents extreme immediate hazard conditions to occupants. These would include any one or more of the following: oxygen deficiency; potentially flammable or explosive atmospheres; or toxic IDLH atmospheres. Specific measurements :

- | | | |
|----|------------------------|---|
| 1. | Oxygen: | Less than 19.5% |
| 2. | Lower Explosive Limit: | Greater than 10% |
| 3. | Toxic Atmosphere: | Greater than IDLH (or possible to exceed) |

Personnel will wear Level B protection during entry.

E. Confined Space Class B

A space that has potential for developing adverse health and safety conditions for personnel if preventative measures are not taken. Specific measurement parameters:

- | | | |
|----|---------|--|
| 1. | Oxygen: | 19.5% - 24.9% |
| 2. | LEL: | Less than 10% |
| 3. | Toxic: | Greater than PEL but less than IDLH and Respirator MAC |

Personnel will wear Level C protection during entry.

F. Confined Space Class C

A confined space that has limited health hazards such that Respiratory Protection is not needed for work procedures. Specific measurement parameters:

- | | | |
|----|---------|---------------|
| 1. | Oxygen: | 19.5 to 24.9% |
|----|---------|---------------|

2. LEL: Less than 10%
3. Toxic: Less than PEL

Personnel can wear Level D protection during entry.

G. Confined Space Entry Permit

1. An RET form (RET-041) to be filled out prior to any confined space entry. Complete use of the form will insure that all health and safety considerations have been addressed prior to entry. This form is signed by all personnel and acts as a permit for the entry. This form is used in conjunction with this procedure to determine special precautions necessary for entry.
2. The second side of the form contains a section for recording air monitoring and equipment calibration data.
3. The permit becomes a permanent part of the job file. An example form is attached.

H. Fall Protection

Equipment and procedures utilized to prevent falls while entering and exiting a confined space. A specific RET procedure titled "Fall Protection Procedures, (March 1989, Rev.2) is to be followed when fall potentials or difficult retrieval conditions exist.

I. Hot Work

Any work being performed that presents an ignition or heat source. Examples are: welding, grinding, burning, chop saw abrasive disk usage, or chipping.

J. Inerting

1. The process of purging the atmosphere of a space with an inert gas (one which will not support combustion) to eliminate the potential for fire or explosion. The typical gas used will be either carbon dioxide or nitrogen. Inerting does not remove the source of flammable vapor (i.e. flammable liquids) but instead removes the oxygen/flammable vapor above the liquid.
2. Use the Riedel procedure titled "Tank Inerting Demolition / Repair Procedure" (March 30, 1991, Rev. 4) when inerting procedures are needed.

3. Personnel are not to enter tanks that have been previously inerted until the space has been purged with fresh air (returned to 19.5% or greater) and LEL is below 10%.

K. Intrinsically Safe/Explosion Proof

1. Electrical equipment which does not present the potential for electrical spark and/or which is designed and constructed to contain any fire or explosion inside the unit preventing propagation of fire back into the general environment. This equipment has been certified as safe for use in flammable atmospheres.
2. All electrical equipment taken into a space containing (or previously containing) flammable liquids or vapors will be rated Class I Group C & D at a minimum, and Class II, Group G at a minimum.

L. Isolation

The act of ensuring that the space cannot be accidentally refilled with product with produce and/or re-energized electrically or mechanically while personnel are inside.

M. Lockout

1. The act of physically locking out electrical, hydraulic, or pneumatic controls and/or mechanical linkage to ensure isolation. Typically performed by lock and key or the physical removal of key components that make it impossible for a system to be restarted while personnel are working on or inside the system.
2. A Riedel procedure titled "Electrical and Mechanical Lockout" is to be used when lockout is needed.

N. Mechanical Ventilation

1. A method of providing ventilation into a confined space. Typically provided by electrically powered or air driven blowers. From a ventilation engineering standpoint, air blown into a space is the most effective method of ensuring consistent dilution inside the space.
2. Negative pressure can be provided by placing the blower or its ductwork inside the space. This method can be effective in ensuring that clean air is drawn into the space, but is not as effective in producing uniform dilution of contaminants.

3. Use of continuous mechanical ventilation will be necessary when working inside Class A or B spaces. Sufficient ventilation must be provided to maintain RET prescribed acceptable flammable, toxic, and oxygen levels.
4. Flexible tubing or duct work may be used to distribute air to all areas of the space. Ventilation equipment must be bonded and grounded.
5. Considerations must be made for dealing with flammable vapors displaced from a space. Exhausted gas may have to be ducted to a safe location.

O. Natural (Gravity) Ventilation

Ventilation provided to a space by non-mechanical means. Air moving into a space opening would be considered natural ventilation. This is not an effective method for ensuring the safety of personnel and/or reducing the flammability potential inside the confined space.

P. Oxygen Deficiency

An atmosphere where oxygen concentration is less than 19.5% by volume. State and Federal safety regulations require that personnel wear air supplied respirators in oxygen deficient atmospheres.

Q. Oxygen Enriched

An atmosphere where oxygen concentration is greater than 25% by volume. Fire and explosion potentials are increased greatly.

R. Purging

The displacement of the atmosphere inside a space with fresh air. All confined spaces must be purged prior to entry by personnel.

S. Emergency Retrieval Equipment

1. Mechanical hoist equipment designed to raise and lower personnel from a space. This equipment is attached to a tripod or other supporting structure which is also capable of being a support platform for other fall protection equipment. All equipment used for raising or lowering personnel will be rated for such operations by the manufacturer.
2. Use of this equipment is described in the Riedel procedure "Fall Protection Procedures".

T. Rescue Person

A person dressed to the same level of protection as the entry person. This individual's sole function is rescue. A rescue person will be required for all Class A entries.

U. Support Person

A person who will be stationed outside a confined space while workers are inside. This person does not have other duties that will take him / her away from the confined space while workers are inside.

V. Saddle Vent

A piece of equipment that allows a ventilation duct to be placed in a manhole or other small entries and still allow personnel to enter/exit without the duct being removed. This allows continuous ventilation inside the space.

W. Unknown Hazard

A space where the hazard potential is unknown. Air monitoring from outside the space is unable to determine if all areas inside are free of hazard. In these cases, personnel will consider the space Class A.

X. Zero Mechanical State (ZMS)

The point where all power sources, that can produce a machine member movement, have been neutralized. This includes all pneumatic, electrical, and mechanical components.

III. POTENTIAL HAZARDS

The following represent the general hazards that can be expected in the variety of confined space jobs RET personnel have or will be exposed to. Each hazard must be assumed until proved otherwise:

- A. Insufficient or Enriched Oxygen
- B. Toxic dusts, mists, fumes, smoke, vapor and gas.
- C. Flammable and explosive gases, liquids, vapors, and dusts
- D. Inadequate access opening for entry/egress

- E. Start up of agitators, tumblers, crushers, mixing blades, screw conveyors, saws, etc.
- F. Avalanche of materials or falling objects
- G. Opening of feed lines which introduce corrosives, heated or gaseous substances such as steam, water, blast furnace gas, or other substances hazardous to health.
- H. Electrical shock or electrocution from plug-in lights, tools, or other portable equipment.
- I. Temperature extremes
- J. Pressurized lines containing hydraulic oil, gas, or other fluids.
- K. Inadequate illumination
- L. Distance of work area from exit and obstacles in between.

IV. ENTRY PROCEDURES SUMMARY

A. Confined Space Classification

Specific requirements for entry into confined spaces will be based on the space classification. These requirements are summarized on a one page summary form. An "X" next to each sub item means that specific item is a requirement. An "O" next to the item means that it is an option based on the specifics of that entry. The Riedel Safety Manager has the responsibility for determining what optional items will be required on the project.

B. Confined Space Entry Permit System

An Entry Permit shall be completed prior to entry into any confined space. This permit shall be available at the work site location of the confined space and shall be dated and valid for one shift only.

1. The Riedel Entry Permit (RET-041) is required for all entries.
2. All questions on the form must be filled out. Pay close attention to identifying the correct classification of the space.
3. When answering the questions on side 1 of the permit, the goal is to have a "yes" answer to each question. In some cases, a "n/a" is appropriate

and would indicate that the specific item does not apply to the situation. Use caution when deciding that the item is "n/a".

4. Special attention must be directed to any question where the answer is "no". A "no" answer may indicate that adequate precautions have not been taken or that a hazard possibly continues to exist. Entry will not be made until all "no" conditions have been corrected.
5. The Entry permit cannot be completed until all testing and sampling has been accomplished. This means that it must be filled out at the site under actual working conditions.
6. The project Safety Officer, as named on the entry permit, shall evaluate, plan, and implement the procedures necessary to safeguard the personnel assigned to the job. He/she has responsibility to evaluate/approve any "n.a" or "no" answers on the permit. Any questions must be submitted to the Regional Health and Safety Manager for clarification.

C. Work Space History

Efforts should be made to determine the present and previous products contained in the confined space. This information should be listed on the permit form.

D. Atmosphere Testing (Initial / Continuous)

1. Prior to entry, all spaces will be initially tested for flammable vapors and oxygen deficiency, plus toxic vapor or gases (based on the potential for toxics being present). It is recognized that the condition in some spaces may change over time. Initial testing may underestimate hazards in these situations.
2. The person assigned the task of monitoring shall know the proper procedure for calibration and operation of all sampling equipment.
3. Combustible Gas Indicators
 - a. CGIs will be span checked (with Span Gas recommended by manufacturer) :
 - [1] prior to first use on each shift
 - [2] If dropped or subjected to 'rough' transport
 - [3] If meter response becomes inconsistent

- b. The CGI will be calibrated if meter response differs from span gas concentration as stated on bottle.
 - c. CGIs will not be used for certifying an area "safe for entry" if a span check has not been made and / or is out of calibration.
 - d. Once tank/space measurements begin, the LEL meter results will be compared to the manufacturer's response charts for the specific contaminant to determine the actual LEL reading.
- 4. Oxygen meters used to confirm the completeness of inerting will be tested with a 100% inert gas atmosphere to ensure that the meter will read 0% oxygen.
 - 5. When monitoring, measurements will be made from top to bottom and in all remote sections of the space. It may be necessary to enter the space to test remote locations. In these situations, personnel will be dressed in Level B PPE and will have rescue personnel available who are also dressed to the same level of PPE.
 - 6. All measurement results will be recorded.
 - 7. Continuous monitoring of flammable, oxygen, and/or toxics will be necessary where conditions could possibly change over a short period of time. Examples are: welding or cutting inside a tank, some cleaning operations, accidental release of product into the space, etc.
 - 8. Once ventilation is started, periodic checks should be made of the surrounding area to insure that contaminated air is exhausted in a location that creates no hazard to people or equipment.
 - 9. Remove personnel from the area if monitoring demonstrates that ventilation is not sufficient to maintain the atmosphere below 10% LEL.

E. Isolation / Lockout / Zero Mechanical State

Before entering any confined space personnel will take sufficient steps to ensure that it is impossible for toxic contaminants, or potentially hazardous products to reenter a space or hazardous situations to develop while personnel are inside.

1. Electrical Isolation/Lockout

- a. Shall be achieved by locking circuit breakers and/or operation controls into the OFF position with a key type padlock.

- b. Ideally the key is to remain with the person working inside the confined space. In some cases it may be more feasible for one supervisor to have the lock for an entire trade group with the understanding that this supervisor is responsible for insuring all individuals are safely accounted for before removing the lock.

2. Mechanical/Pneumatic Isolation

- a. Isolation of all moving parts shall be achieved by disconnecting or capping any linkage, valves, drive belts, shafts, water/steam lines, chaining controls, or systems which enter, feed, or impact in the confined space.
- b. Equipment with moving mechanical parts shall be blocked so that there can be no accidental movement.
- c. Pneumatic and hydraulic lines will be bled to remove any remaining pressure (ZMS) to remove possibility of equipment movement.

3. General Guidelines

- a. Make certain that you can't accidentally re-energize a system, ie that there are not any additional run buttons that you might have missed.
 - b. Try all operator switches in all control positions.
 - c. Before using voltage tester on unknown system, try it on a known energy source.
 - d. Check circuits on the load side after they have been disconnected.
 - e. After performing voltage check, recheck tester on a known source.
 - f. Discharge any electrical or mechanical component that can contain potential energy.
4. While performing work at a non Riedel location, it is not always possible to have total control over a client's property. When there is question about the adequacy of isolation, RET job managers are required to contact the Riedel Safety Coordinator/Manager to ensure that adequate steps are being taken.

F. Purging and Ventilation

1. Prior to entry, mechanical ventilation will be initiated for Class A and B spaces to reduce, or maintain flammable vapor levels to 10% LEL or less and oxygen concentrations to at least 16.5% or greater.
2. Continuous ventilation shall be maintained in Class A/B spaces. Continuous ventilation is not needed in Class C if there is no possibility of contaminant generation while personnel are inside.
3. Provisions for continuous ventilation will be maintained in Class A/B spaces. Decisions to periodically shut down ventilation (to allow easier communication, adding / removing equipment etc) are acceptable provided the desired atmosphere can be maintained. Ventilation is not always sufficient to ensure that toxic environments are rendered safe (below PEL or IDLH concentrations) even though acceptable flammable / oxygen levels are maintained.
4. Note that this ventilation will discharge contaminants outside the space and will therefore present exposure potentials to outside personnel. This discharge may also present fire or explosion hazards outside the space.
5. Electrical fans will not be placed inside a space that contains flammable vapors.
6. When entering manholes or other small openings, a saddle vent will be utilized if the duct work will interfere with entry / egress. An alternative is to use flexible poly tubing which can be easily compressed and will allow passage without removal.
7. Ventilator air intakes shall be located so they will not pickup exhaust gases from vehicles, heaters, furnaces, or adjacent operations capable of generating airborne contaminants.
8. Duct work should be placed so that all unnecessary bends are eliminated. One 90 degree bend can reduce the output to 70% of rated capacity; two 90 degree bends to 50%, three bends to 33%, etc.
9. Exhaust vs Dilution Ventilation

Local exhaust ventilation shall be provided when Dilution ventilation is not capable of preventing a point source contaminant from producing

unacceptable high concentrations in the ambient atmosphere. Example: spreading a flammable solvent on a surface inside a tank, welding fumes, etc.)

G. Safety Equipment

The following equipment requirements are to be considered minimum and must be provided prior to start up and initial entry of the individual.

1. Oxygen and Combustible Gas Indicators, calibration kit, and response chart appropriate to test for and interpret the flammable atmosphere.
2. Photo Ionizing Detector, Detector tubes as appropriate to determine toxic content of atmosphere.
3. Mechanical ventilation equipment, ie blowers, compressor, hoses, and auxiliary equipment as designated for the confined space.
4. Respiratory/Face protection
 - a. The exact level and type shall be determined by the regional health and safety officer based upon the conditions and test results of the confined space and the work activity performed. Full face protection, ie full-face respirator (category A/B) or full-face plexiglass shield for category C if eye/skin irritating mists, chemicals, vapors, or dusts are present.
 - b. All respirators shall be NIOSH/MSHA approved devices and shall be fitted and maintained in accordance with the RET Respiratory Protection policy.
 - c. All persons wearing respirators in a confined space and rescue personnel shall have attended a respiratory training program on the specific respiratory equipment they are wearing.
5. Body Protection:

All workers entering a confined space shall wear full coverage work clothes sufficient to protect the wearer against known or suspected toxic or irritating materials. Specific type of suit material will be described in the permit.

6. **Hearing Protection**

Many times, reverberation or ventilation systems result in increased noise levels in confined spaces. Hearing protection shall be used when personnel are working around equipment producing potentially hazardous noise.

7. All workers shall wear a hard hat.

8. **Lighting**

- a. All portable lights shall be intrinsically safe/explosion proof when working in potentially flammable atmospheres.
- b. Heavy duty flexible cords will be used with good insulation and connectors. No splices are permitted. Cracked or worn insulation shall be replaced.
- c. Lighting shall not be suspended by cords unless specifically designed for it.
- d. All lights and plug assemblies should be checked with a volt/ground meter prior to use in confined space.

9. **Rescue Equipment**

The specific type and degree of rescue equipment will depend upon the nature of the confined space with regard to access/egress. This decision would take into account the exact manner in which the individual could be feasibly extracted ie by the wrists, waist, straight up and the accompanying strain to the persons body.

- a. A body harness/belt is required when an employee is working in an area that, for purposes of rescue, is considered restricted and when any failure of ventilation could allow the build-up of toxic or explosive gases within the time necessary to vacate the area.
- b. A body harness is required for any vertical entry. A belt will usually be satisfactory for horizontal entry.
- c. If the worker in the confined space is required to wear a harness, the rescue/stand-by person shall also have a safety harness and air supplied respirator immediately available.

- d. Additional rescue equipment such as tripod, block and tackle, lifelines:
 - [1] shall be available, set-up, and in working order , before initial entry if needed to remove a worker from a confined space.
 - [2] This equipment must be capable of being hand operated.
- e. Decisions to downgrade requirements for harnesses / belts attached to lifelines can be made by the Site Health and Safety Officer after space conditions have been surveyed and understood.

H. REQUIRED PERSONNEL

Outside / additional personnel must always be available to handle communication, support equipment and to provide assistance or emergency aid as necessary during all entries. The exact number of personel needed will depend on the complexity of the project (four or more may be necessary to support ONE entry person).

1. Support person

- a. All space entries require a standby person assigned to the project. This person's duties include maintaining communication and providing necessary assistance to workers inside.
- b. This individual's primary responsibilities with Class A and B spaces are the initiation of rescue procedures (although this person will never go inside the space).
- c. Support persons cannot leave a Class A or B space for any reason.
- d. Class A and B spaces require that at least two other personnel are in the immediate area and can be summoned without the standby person having to leave the area.
- e. Class C spaces only require that the person keep a general watch on those inside. Communication is either direct verbal or indirect/direct visual.

2. Rescue Person

a. Class A Spaces

Require that the rescue person be dressed to the same level of protection as the workers he is assigned to. He must be on station at the opening to the space in direct line of sight with those inside. This person will be on station the entire time that operations are being conducted.

b. Class B Spaces

Rescue person not needed.

c. Class C Spaces:

Rescue person not needed.

**RIEDEL ENVIRONMENTAL TECHNOLOGIES
CHECK LIST OF CONSIDERATIONS FOR ENTRY,
WORKING IN AND EXITING CONFINED SPACES**

<u>ITEM</u>	<u>CLASS A</u>	<u>CLASS B</u>	<u>CLASS C</u>
1. Riedel Confined Area Entry Permit	x	x	x
2. Initial Atmospheric Testing for Combustibles & Oxygen	x	x	x
3. Continuous Air Monitoring	x	x	0
4. Pre-entry Briefing of Personnel	x	x	x
5. Pre-entry Space Preparation			
Isolate/lockout/electrical & mechanical	x	x	x
Purge and continuous ventilation	x	x	0
Requirements for special equipment/tools	x	x	0
6. Entry procedures			
Initial written plan with job objectives	x	x	x
Support person on station	x	x	x
Rescue person station (dressed to respond)	x	0	0
7. Safety Equipment and clothing			
Head protection	x	x	x
Hearing protection (> 85dBA)	x	x	x
Hand protection (depending on contaminant)	x	x	x
Foot protection (depending on contaminant)	x	x	x
Body protection (depending on contaminant)	x	x	x
Respiratory protection	x	x	0
Safety belts with life lines	x	x	0
Life lines, harness, retrieval pulley (vertical entry)	x	x	x
8. Rescue procedures developed	x	x	x
9. Record keeping (equipment calibration, permits)	x	x	x

x = indicates requirement

0 = indicates determination by Riedel Safety Professional

ENTRY CHECKLIST	Page	of	Pages
DATE: _____	JOB NUMBER: _____		
DATE ENTERED: _____			
CLASSIFICATION OF CONFINED SPACE:) CLASS C: >19.5% O ₂ , <10% LEL, <TLV) CLASS B: >19.5% O ₂ , <10% LEL, >TLV, <IDLH, <MAC) CLASS A: <19.5% O ₂ , >10% LEL, >IDLH, >MAC			
CHEMICAL CONTAMINANTS: _____			
DESCRIPTION OF WORK: _____			
NUMBER OF PEOPLE REQUIRED ON PROJECT: _____			
TIME ISSUED: _____	VALID UNTIL: _____		
PERMIT IS VOID AT THE END OF THE WORK SHIFT ON WHICH IS IT ISSUED.	YES	NO	N/A
Were hazards, testing and emergency procedures explained to all members of crew?			
All chemical and gas delivery lines are disconnected and/or capped?			
Stand electrical, mechanical, pneumatic power sources have been reduced to zero energy state (ZES)?			
Controls to all power sources are locked and tagged out?			
Monitoring equipment has been calibrated/span checked?			
Combustible gas vapors are less than 10% LEL?			
Oxygen concentration is greater than 19.5%			
Toxic gas/vapor concentrations are less than IDLH?			
Forced ventilation is in use as required?			

DIRECT READING INSTRUMENT CALIBRATION

TIME	INSTRUMENT USED	LEL SPAN CONC.	LEL ACTUAL	H2S SPAN CONC.	H2S ACTUAL	CO SPAN CONC.	CO ACTUAL	OXY SPAN CONC.	OXY ACTUAL

AIR MONITORING DATA

TIME	INSTRUMENT USED	CONTAMINANT (LEL, O2, ETC.)	MEASURED LEVEL

TIME	INSTRUMENT USED	CONTAMINANT (LEL, O2, ETC.)	MEASURED LEVEL

PROJECT EQUIPMENT REQUIREMENTS

Personnel Protective Equipment

_____ Outer Suit Type _____
 _____ Chemical Boots
 _____ Outer Gloves Type _____
 _____ Hard Hat
 _____ Eye Protection

Respirators

_____ SCBA
 _____ Supplied Air with 5-minute Egress
 _____ Grade D Air Cylinders
 _____ Compressor with Purification Panel

APPENDIX C

MSDS SHEETS

CHEMICAL INFORMATION SHEETS



991001700

UNION CARBIDE CORPORATION
CARBON PRODUCTS DIVISION

MATERIAL SAFETY DATA SHEET

(Essentially similar to Form OSHA-20)

SECTION I	
Manufacturer's Name UNION CARBIDE CORPORATION, Carbon Products Div.	Emergency Telephone No. (304) 744-3487 (Day or Night)
Address (Number, Street, City, State, and ZIP Code) 270 Park Avenue, New York, New York 10017	
Product: ACTIVATED CARBON	Trade Name and Synonyms "Columbia" - All Grades

SECTION II - HAZARDOUS INGREDIENTS					
MATERIAL	%	TLV *	MATERIAL	%	TLV *
None as defined by United					
States Department of Labor					
29 CFR 1915, 1916, 1917					

* Current American Conference of Governmental Industrial Hygienist Limits.

SECTION III - PHYSICAL DATA			
BOILING POINT (°F.)	N/A	SPECIFIC GRAVITY (H ₂ O=1)	0.9
VAPOR PRESSURE (mm Hg.)	N/A	PERCENT VOLATILE BY VOLUME (%)	N/A
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (_____ =1)	N/A
SOLUBILITY IN WATER	None		
APPEARANCE AND ODOR	Black odorless granules		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	N/A	FLAMMABLE LIMITS % by Volume	Le1 = N/A Ue1 = N/A
EXTINGUISHING MEDIA	Water, foam, CO ₂ , dry chemicals		
SPECIAL FIRE FIGHTING PROCEDURES	N/A		
UNUSUAL FIRE AND EXPLOSION HAZARDS Fire and explosive hazard of adsorbed materials must be identified and adequate protective measures taken.			

Continued on reverse side

SECTION V - HEALTH HAZARD DATA	
THRESHOLD LIMIT VALUE	10 mg/m ³ (ACGIH limit for nuisance dusts)
EFFECTS OF OVEREXPOSURE Inhalation of activated carbon dust may cause temporary respiratory irritation and discomfort. Potential hazard of adsorbed materials on used activated carbon should be identified.	
EMERGENCY AND FIRST AID PROCEDURES	
N/A	

SECTION VI - REACTIVITY DATA			
STABILITY	UNSTABLE		CONDITIONS TO AVOID N/A
	STABLE	X	
INCOMPATIBILITY (Materials to avoid) N/A			
HAZARDOUS DECOMPOSITION PRODUCTS N/A			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID N/A
	WILL NOT OCCUR	X	

SECTION VII - SPILL OR LEAK PROCEDURES	
STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED	
Follow good housekeeping practices.	
WASTE DISPOSAL METHOD Dispose of in approved landfill, recognizing the potentially hazardous nature of adsorbed materials.	

SECTION VIII - SPECIAL PROTECTION INFORMATION			
RESPIRATORY PROTECTION (Specify type) For above TLV dust concentration, wear NIOSH-approved respirator.			
VENTILATION	LOCAL EXHAUST	N/A	Special N/A
	MECHANICAL (General) Maintain dust level below TLV		Other None
PROTECTIVE GLOVES Recommended		EYE PROTECTION Safety glasses or goggles.	
OTHER PROTECTIVE EQUIPMENT N/A			

SECTION IX - SPECIAL PRECAUTIONS	
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING Do not enter vessel containing activated carbon without adequate breathing air supply.	
Closed vessels may be low in oxygen level due to adsorbing characteristics of activated carbon. New activated carbon - store in closed containers indefinitely. Outside storage keep on pallets and under tarpaulins to keep container dry. Do not breathe dust.	

OILS, FUEL: 1-D			OOD
Common Synonyms Diesel oil (light)	Oily liquid Floats on water.	Yellow-brown	Lube or fuel oil odor

Stop discharge if possible.
 Call fire department.
 Avoid contact with liquid.
 Isolate and remove discharged material.
 Notify local health and pollution control agencies.

Fire	Combustible. Extinguish with dry chemical, foam or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.
Water Pollution	Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

MATERIAL SAFETY DATA SHEET

Distributor:
General Air Service & Supply
1105 Luna Street
Denver, Colorado 80204
(303) 892-7003

Manufacturer:
Liquid Air Corporation
One Embarcadero Center
San Francisco, CA 94111
(415) 765-4500

Product Supplied: Reconstituted Breathing Air
Sold To: RIEDEL ENVIRONMENTAL SERVICES
5850 EAST 58TH AVE, SUITE F
COMMERCE CITY, CO 80022

SECTION I

PRODUCT NAME: Reconstituted Breathing Air
SYNONYMS: CGA Grade E Breathing Air
FORMULA: O₂-N₂
CHEMICAL FAMILY: Gas
ISSUE DATE: 2/19/85
DOT HAZARD CLASS: Nonflammable Gas
DOT ID NUMBER: UN1002

SECTION II - HAZARDOUS INGREDIENTS

None

SECTION III - PHYSICAL DATA

BOILING POINT: -300 F
LIQUID DENSITY AT BOILING POINT: N/A
VAPOR PRESSURE: N/A
GAS DENSITY: 0.28
SOLUBILITY IN WATER: Slight
SPECIFIC GRAVITY: 1.00
APPEARANCE AND ODOR: Colorless and Odorless Gas

SECTION IV - FIRE & EXPLOSION HAZARD DATA

FLASH POINT (Method Used): None - Nonflammable
FLAMMABLE LIMITS: LEL 0% UEL 0%
EXTINGUISHING MEDIA: None
SPECIAL FIRE FIGHTING PROCEDURES: Remove from direct heat or open flame, or keep cool with water fog

SECTION V - HEALTH HAZARD DATA

None

SECTION VI - REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID: None

HAZARDOUS POLYMERIZATION: Will not occur

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Leaks will dissipate rapidly and harmlessly to atmosphere

WASTE DISPOSAL METHOD: Vent to atmosphere in open area. Remove valves

SECTION VIII - SPECIAL PROTECTION INFORMATION

None

STORAGE RECOMMENDATIONS: Do not drop cylinders. Keep valve protection caps in place except when using. Store away from direct heat or open flame. Refer to CGA-P1, "Safe Handling of Compressed Gases", or OSHA 1910 Subpart H.

SECTION IX - SPECIAL PRECAUTIONS

May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (As Used on Label and List)

ALCONOX

Note: Blank spaces are not permitted. If any item is not applicable, or no
information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name

ALCONOX, INC.

Emergency Telephone Number

(212) 473-1300

Address (Number, Street, City, State, and ZIP Code)

215 PARK AVENUE SOUTH

Telephone Number for Information

(212) 473-1300

NEW YORK, N.Y. 10003

Date Prepared

JULY 1, 1987

Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identify Information

Hazardous Components (Specific Chemical Identity, Common Name(s))	OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
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THERE ARE NO INGREDIENTS IN ALCONOX WHICH APPEARED ON THE
OSHA STANDARD 29 CFR 1910 SUBPART Z.

Section III — Physical/Chemical Characteristics

Boiling Point	N.A.	Specific Gravity (H ₂ O = 1)	N.A.
Vapor Pressure (mm Hg.)	N.A.	Melting Point	N.A.
Vapor Density (AIR = 1)	N.A.	Evaporation Rate (Butyl Acetate = 1)	N.A.

Solubility in Water

APPRECIABLE (GREATER THAN 10 PER CENT)

Appearance and Odor

WHITE POWDER INTERSPERSED WITH CREAM COLORED FLAKES - ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)	Flammable Limits	LEL	UEL
NONE		N.A.	N.A.

Extinguishing Media

WATER, CO₂, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures

FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT

PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS

Unusual Fire and Explosion Hazards

NONE

	Stable	XX	NONE
Incompatibility (Materials to Avoid)			
AVOID STRONG ACIDS			
Hazardous Decomposition or Byproducts			
MAY RELEASE CO₂ GAS ON BURNING			
Hazardous Polymerization	May Occur		Conditions to Avoid ²
	Will Not Occur	XX	NONE
Section VI — Health Hazard Data			
Route(s) of Entry:	Inhalation?	YES	Skin? NO Ingestion? YES
Health Hazards (Acute and Chronic)			
INHALATION OF POWDER MAY PROVE LOCALLY IRRITATING TO MUCOUS MEMBRANES. INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA.			
Carcinogenicity:	NTP?	NO	IARC Monographs? NO OSHA Regulated? NO
Signs and Symptoms of Exposure			
EXPOSURE MAY IRRITATE MUCOUS MEMBRANES. MAY CAUSE SNEEZING.			
Medical Conditions Generally Aggravated by Exposure			
RESPIRATORY CONDITIONS MAY BE AGGRAVATED BY POWDER.			
Emergency and First Aid Procedures			
EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES. SKIN-FLUSH WITH PLENTY OF WATER. INGESTION-DRINK LARGE QUANTITIES OF WATER. GET MEDICAL ATTENTION FOR DISCOMFORT.			
Section VII — Precautions for Safe Handling and Use			
Steps to Be Taken in Case Material Is Released or Spilled			
MATERIAL FOAMS PROFUSELY. SHOVEL AND RECOVER AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.			
Waste Disposal Method			
SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGENT.			
Precautions to Be Taken in Handling and Storing			
STORE IN A DRY AREA TO PREVENT CAKING.			
Other Precautions			
NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.			
Section VIII — Control Measures			
Respiratory Protection (Specify Type)			
DUST MASK			
Ventilation	Local Exhaust	NORMAL	Special N.A.
	Mechanical (General)	N.A.	Other N.A.
Protective Gloves		USEFUL-NOT REQUIRED	Eye Protection USEFUL-NOT REQUIRED
Other Protective Clothing or Equipment			
NOT REQUIRED			
Work/Hygienic Practices			
NO SPECIAL PRACTICES REQUIRED			

Topic: ACETONE

OVERVIEW

Material name:

ACETONE

Common synonyms:

Dimethyl ketone

Propanone

2-Propanone

Characteristics:

Watery liquid Colorless Sweet odor

Floats and mixes with water. Flammable, irritating vapor is produced.

Emergency actions:

Stay upwind and use water spray to "knock down" vapor.

Shut off ignition sources and call fire department. Keep people away.

Stop discharge if possible.

Isolate and remove discharged material.

Avoid contact with liquid and vapor.

Notify local health and pollution control agencies.

Fire:

FLAMMABLE.

Flashback along vapor trail may occur.

Vapor may explode if ignited in an enclosed area.

Extinguish with dry chemical, alcohol foam, or carbon dioxide.

Water may be ineffective on fire.

Cool exposed containers with water.

Exposure:

CALL FOR MEDICAL AID.

VAPOR

Irritating to eyes, nose and throat.

If inhaled, may cause difficult breathing or loss of consciousness.

Move to fresh air.

If breathing has stopped, give artificial respiration.

If breathing is difficult, give oxygen.

LIQUID

Irritating to eyes.

Not irritating to skin.

IF IN EYES, hold eyelids open and flush with plenty of water.

Water pollution:

Dangerous to aquatic life in high concentrations.

May be dangerous if it enters water intakes.

Notify local health and pollution control officials.

Notify operators of nearby water intakes.

RESPONSE TO DISCHARGE

Issue warning-high flammability Disperse and flush

LABEL

Category: Flammable liquid

Class: 3

CHEMICAL DESIGNATIONS

CG compatibility class: Ketone

Formula: CH₃COCH₃

IN / UN designation: 3.1/1090

Topic: ACETONE

DOT id no.: 1090

CAS registry no.: 67-64-1

OBSERVABLE CHARACTERISTICS

Physical state: Liquid

Color: Colorless

Odor: Sweetish; pleasant, resembling that of mint or fruit;
pungent; sharp, penetrating residual; ketonic, pleasant,
non-residual

HEALTH HAZARDS

Personal protective equipment: Organic vapor canister or
air-supplied mask; synthetic rubber gloves; chemical safety
goggles or face splash shield.

Symptoms following exposure: INHALATION: vapor irritating
to eyes and mucous membranes; acts as an anesthetic in very
high concentrations. INGESTION: low order of toxicity but
very irritating to mucous membranes. SKIN: prolonged
excessive contact causes defatting of the skin, possibly
leading to dermatitis.

Treatment of exposure: INHALATION: if victim is overcome,
remove to fresh air and call a physician; administer
artificial respiration if breathing is irregular or
stopped. INGESTION: if victim has swallowed large amounts
and is conscious and not having convulsions, induce
vomiting and get medical help promptly; no specific
antidote known. SKIN: wash well with water. EYES: flush
with water immediately for at least 15 min. Consult a
physician.

Threshold limit value: 750 ppm

Short term inhalation limits: 1000 ppm for 30 min.

Toxicity by ingestion: Grade 1; LD(50) = 5 to 15 g/kg (dog)

Late toxicity: Not pertinent

Vapor (gas) irritant characteristics: If present in high
concentrations, vapors cause moderate irritation of the
eyes or respiratory system. Effect is temporary.

Liquid or solid irritant characteristics: No appreciable
hazard. Practically harmless to the skin because it is very
volatile and evaporates quickly from the skin.

Odor threshold: 100 ppm

IDLH value: 20000 ppm

FIRE HAZARDS

Flash point: 4 degrees F O.C.; 0 degrees F C.C.

Flammable limits in air: 2.6%-12.8%

Fire extinguishing agents: Alcohol foam, dry chemical,
carbon dioxide

Fire extinguishing agents NOT to be used: Water in straight
hose stream will scatter and spread fire and should not be
used.

Special hazards of combustion products: Not pertinent

Behavior in fire: Not pertinent

Ignition temperature: 869 degrees F

Electrical hazard: Class I, Group D

Burning rate: 3.9 mm/min.

Adiabatic flame temperature: Data not available

Stoichiometric air to fuel ratio: Data not available

Flame temperature: Data not available

Topic: ACETONE

CHEMICAL REACTIVITY

Reactivity with water: No reaction
 Reactivity with common materials: No reaction
 Stability during transport: Stable
 Neutralizing agents for acids and caustics: Not pertinent
 Polymerization: Not pertinent
 Inhibitor of polymerization: Not pertinent
 Molar ratio (reactant to product): Data not available
 Reactivity group: 18

WATER POLLUTION

Aquatic toxicity: 14,250 ppm/24 hr/sunfish/killed/tap water
 13,000 ppm/48 hr/mosquito fish/TLM/ turbid water
 Waterfowl toxicity: Not pertinent
 Biological oxygen demand (BOD): (Theor) 100%, 5 days
 Food chain concentration potential: None noted

SHIPPING INFORMATION

Grades of purity: Technical: 99.5% plus 0.5% water Reagent:
 99.5% plus 0.5% water
 Storage temperature: Ambient
 Inert atmosphere: No requirement
 Venting: Open (flame arrester) or pressure-vacuum

HAZARD CLASSIFICATIONS

Code of federal regulations: Flammable liquid

HAS HAZARD RATING FOR BULK WATER TRANSPORTATION:

Category	Rating
Fire.....	3
Health	
Vapor Irritant.....	1
Liquid or Solid Irritant.....	0
Poisons.....	0
Water Pollution	
Human Toxicity.....	1
Aquatic Toxicity.....	1
Aesthetic Effect.....	1
Reactivity	
Other Chemicals.....	2
Water.....	0
Self Reaction.....	1

HFFA HAZARD CLASSIFICATION:

Category	Classification
Health Hazard (Blue).....	1
Flammability (Red).....	3
Reactivity (Yellow).....	0

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C. and 1 ATM: Liquid
 Molecular weight: 58.08
 Boiling point at 1 ATM: 133 degrees F = 56.1 degrees C =
 329.3 degrees K
 Freezing point: -138 degrees F = -94.7 degrees C = 178.5
 degrees K
 Critical temperature: 455 degrees F = 235 degrees C = 508
 degrees K
 Critical pressure: 682 psia = 46.4 atm = 4.70 MN/m(2)
 Specific gravity: 0.791 at 20 degrees C (liquid)
 Liquid surface tension: Not pertinent

Topic: ACETONE

Liquid water interfacial tension: Not pertinent
Vapor (gas) specific gravity: 2.0
Ratio of specific heats of vapor (gas): 1.127
Latent heat of vaporization: 220 Btu/lb = 122 cal/g = 5.11
X 10(5) J/kg
Heat of combustion: -12,250 Btu/lb = -6808 cal/g = -285.0 X
10(5) J/kg
Heat of decomposition: Not pertinent
Heat of solution: Not pertinent
Heat of polymerization: Not pertinent
Heat of fusion: 23.42 cal/g
Limiting value: Data not available
REID vapor pressure: 7.25 psia

Topic: VINYL CHLORIDE

OVERVIEW

Material name:
VINYL CHLORIDE
Common synonyms:
Chlorethylene
VCL
Vinyl C Monomer
VCM

Characteristics:

Gas Colorless Sweet odor
Liquid floats and boils on water. Flammable, irritating
visible vapor cloud is produced.

Emergency actions:

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Evacuate area in case of large discharge.
Avoid contact with liquid and vapor.
Notify local health and pollution control agencies.

Fire:

FLAMMABLE.
POISONOUS GAS IS PRODUCED IN FIRE.
Flashback along vapor trail may occur.
May explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Cool exposed containers and protect men effecting shutoff
with water.
Stop flow of gas if possible.
Let fire burn.
Extinguish small fires with dry chemical.

Exposure:

CALL FOR MEDICAL AID.
VAPOR
Irritating to eyes, nose, and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.
LIQUID
Will cause frostbite.
Flush affected areas with plenty of water.
DO NOT RUB AFFECTED AREAS.

Water pollution:

Not harmful to aquatic life.

RESPONSE TO DISCHARGE

Issue warning-high flammability Evacuate area

LABEL

Category: Flammable gas
Class: 2

CHEMICAL DESIGNATIONS

CG compatibility class: Vinyl halides
Formula: $\text{CH}_2=\text{CHCl}$
IMO/UN designation: 2.0/1086
DOT id no.: 1086
CAS registry no.: 75-01-4

Topic: VINYL CHLORIDE

OBSERVABLE CHARACTERISTICS

Physical state: Liquefied compressed gas

Color: Colorless

Odor: Pleasant, sweet

HEALTH HAZARDS

Personal protective equipment: Rubber gloves and shoes; gas-tight goggles; organic vapor canister or self-contained breathing apparatus.

Symptoms following exposure: INHALATION: high concentrations cause dizziness, anesthesia, lung irritation. SKIN: may cause frostbite; phenol inhibitor may be absorbed through skin if large amounts of liquid evaporate.

Treatment of exposure: INHALATION: remove patient to fresh air and keep him quiet and warm; call a doctor; give artificial respiration if breathing stops. EYES AND SKIN: flush with plenty of water for at least 15 min.; for eyes, get medical attention; remove contaminated clothing.

Threshold limit value: 5 ppm

Short term inhalation limits: 500 ppm for 5 min.

Toxicity by ingestion: Not pertinent

Late toxicity: Chronic exposure may cause liver damage.

Vapor (gas) irritant characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.

Liquid or solid irritant characteristics: Minimum hazard.

If spilled on clothing and allowed to remain, may cause smarting and reddening of skin. May cause frostbite.

Odor threshold: 260 ppm

IDLH value: Data not available

FIRE HAZARDS

Flash point: -110 degrees F O.C.

Flammable limits in air: 4%-26%

Fire extinguishing agents: For small fires use dry chemical or carbon dioxide. For large fires stop flow of gas. Cool exposed containers with water.

Fire extinguishing agents NOT to be used: Not pertinent

Special hazards of combustion products: Forms highly toxic combustion products such as hydrogen chloride, phosgenic, and carbon monoxide.

Behavior in fire: Container may explode in fire. Gas is heavier than air and may travel considerable distance to a source of ignition and flash back.

Ignition temperature: 882 degrees F

Electrical hazard: Class I, Group D

Burning rate: 4.3 mm/min.

Adiabatic flame temperature: Data not available

Stoichiometric air to fuel ratio: 5.490 (Est.)

Flame temperature: Data not available

CHEMICAL REACTIVITY

Reactivity with water: No reaction

Reactivity with common materials: No reaction

Stability during transport: Stable

Neutralizing agents for acids and caustics: Not pertinent

Polymerization: Polymerizes in presence of air, sunlight,

Topic: VINYL CHLORIDE

or heat unless stabilized by inhibitors.

Inhibitor of polymerization: Not normally used except when high temperatures are expected. Then 40-100 ppm of phenol used.

Molar ratio (reactant to product): Data not available

Reactivity group: 35

WATER POLLUTION

Aquatic toxicity: None

Waterfowl toxicity: None

Biological oxygen demand (BOD): None

Food chain concentration potential: None

SHIPPING INFORMATION

Grades of purity: Commercial or technical 99+%

Storage temperature: Under pressure; ambient At atm. pressure; low

Inert atmosphere: No requirement

Venting: Under pressure; safety relief At atm. pressure; pressure-vacuum

HAZARD CLASSIFICATIONS

Code of federal regulations: Flammable gas

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION:

Category	Rating
Fire.....	4
Health	
Vapor Irritant.....	2
Liquid or Solid Irritant.....	1
Poisons.....	2
Water Pollution	
Human Toxicity.....	0
Aquatic Toxicity.....	0
Aesthetic Effect.....	0
Reactivity	
Other Chemicals.....	2
Water.....	0
Self-Reaction.....	2

NFPA HAZARD CLASSIFICATION:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	4
Reactivity (Yellow).....	1

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C. and 1 ATM: Gas

Molecular weight: 62.50

Boiling point at 1 ATM: 7.2 degrees F = 13.3 degrees C = 259.4 degrees K

Freezing point: -244.8 degrees F = -153.8 degrees C = -119.4 degrees K

Critical temperature: 317.1 degrees F = 158.4 degrees C = 421.6 degrees K

Critical pressure: 775 psia = 52.7 atm = 5.34 MN/m(2)

Specific gravity: 0.969 at -13 degrees C (liquid)

Liquid surface tension: 16.0 dynes/cm = 0.0160 N/m at 25 degrees C

Liquid water interfacial tension: (est.) 30 dynes/cm = 0.03 N/m at 20 degrees C

Topic: VINYL CHLORIDE

Vapor (gas) specific gravity: 2.2

Ratio of specific heats of vapor (gas): 1.186

Latent heat of vaporization: 160 Btu/lb = 88 cal/g = 3.7 X
10(5) J/kgHeat of combustion: -8136 Btu/lb = -4520 cal/g = -189.1 X
10(5) J/kg

Heat of decomposition: Not pertinent

Heat of solution: Not pertinent

Heat of polymerization: -729 Btu/lb = -405 cal/g = 16.9 X
10(5) J/kg

Heat of fusion: 18.14 cal/g

Limiting value: Data not available

REID vapor pressure: 75 psia

Topic: DICHLOROMETHANE

OVERVIEW

Material name:

DICHLOROMETHANE

Common synonyms:

Methylene chloride

Methylene dichloride

Characteristics:

Watery liquid Colorless Sweet, pleasant odor

Sinks in water. Irritating vapor is produced.

Emergency actions:

Stop discharge if possible.

Avoid contact with liquid and vapor.

Isolate and remove discharged material.

Notify local health and pollution control agencies.

Fire:

Not flammable.

POISONOUS GASES ARE PRODUCED WHEN HEATED.

Wear goggles and self-contained breathing apparatus.

Cool exposed containers with water.

Exposure:

CALL FOR MEDICAL AID.

VAPOR

Irritating to eyes, nose and throat.

If inhaled, will cause nausea and dizziness.

Move to fresh air.

If breathing has stopped, give artificial respiration.

If breathing is difficult, give oxygen.

LIQUID

Irritating to skin and eyes.

Harmful if swallowed.

Remove contaminated clothing and shoes.

Flush affected areas with plenty of water.

IF IN EYES, hold eyelids open and flush with plenty of water.

IF SWALLOWED and victim is CONSCIOUS, have victim drink water

or milk.

Water pollution:

Effect of low concentrations on aquatic life is unknown.

May be dangerous if it enters water intakes.

Notify local health and pollution control officials.

Notify operators of nearby water intakes.

RESPONSE TO DISCHARGE

Disperse and flush

LABEL

Category: None

Class: Not pertinent

CHEMICAL DESIGNATIONS

CG compatibility class: Halogenated hydrocarbon

Formula: CH₂Cl₂

IMO/UN designation: 9.0/1593

DOT id no.: 1593

CAS registry no.: 75-09-2

OBSERVABLE CHARACTERISTICS

Physical state: Liquid

Topic: DICHLOROMETHANE

Color: Colorless

Odor: Pleasant, aromatic; like chloroform; sweet, ethereal

HEALTH HAZARDS

Personal protective equipment: Organic vapor canister mask, safety glasses, protective clothing.

Symptoms following exposure: INHALATION: anesthetic effects, nausea and drunkenness. CONTACT WITH SKIN AND EYES: skin irritation, irritation of eyes and nose.

Treatment of exposure: INHALATION: remove from exposure.

Give oxygen if needed. INGESTION: no specific antidote.

CONTACT WITH SKIN AND EYES: remove contaminated clothing; wash skin or eyes if affected.

Threshold limit value: 100 ppm

Short term inhalation limits: 500 ppm for 30 min.

Toxicity by ingestion: Grade 2; LD(50) = 0.5 to 5 g/kg

Late toxicity: None

Vapor (gas) irritant characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.

Liquid or solid irritant characteristics: Minimum hazard.

If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.

Odor threshold: 205-307 ppm

IDLH value: 5,000 ppm

FIRE HAZARDS

Flash point: Not flammable under conditions likely to be encountered.

Flammable limits in air: 12%-19%

Fire extinguishing agents: Not pertinent

Fire extinguishing agents NOT to be used: Not pertinent

Special hazards of combustion products: Dissociation products generated in a fire may be irritating or toxic.

Behavior in fire: Not pertinent

Ignition temperature: 1184 degrees F

Electrical hazard: Not pertinent

Burning rate: Not pertinent

Adiabatic flame temperature: Data not available

Stoichiometric air to fuel ratio: Data not available

Flame temperature: Data not available

CHEMICAL REACTIVITY

Reactivity with water: No reaction

Reactivity with common materials: No reaction

Stability during transport: Stable

Neutralizing agents for acids and caustics: Not pertinent

Polymerization: Not pertinent

Inhibitor of polymerization: Not pertinent

Molar ratio (reactant to product): Data not available

Reactivity group: 36

WATER POLLUTION

Aquatic toxicity: Not pertinent

Waterfowl toxicity: Not pertinent

Biological oxygen demand (BOD): Not pertinent

Food chain concentration potential: None

SHIPPING INFORMATION

Grades of purity: Aerosol grade; technical grade

Topic: DICHLOROMETHANE

Storage temperature: Data not available

Inert atmosphere: Inerted

Venting: Data not available

HAZARD CLASSIFICATIONS

Code of federal regulations: ORM-A

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION:

Category	Rating
Fire.....	1
Health	
Vapor Irritant.....	2
Liquid or Solid Irritant.....	1
Poisons.....	2
Water Pollution	
Human Toxicity.....	1
Aquatic Toxicity.....	1
Aesthetic Effect.....	2
Reactivity	
Other Chemicals.....	1
Water.....	0
Self Reaction.....	0

NFPA HAZARD CLASSIFICATION:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	0
Reactivity (Yellow).....	1

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C. and 1 ATM: Liquid

Molecular weight: 84.93

Boiling point at 1 ATM: 104 degrees F = 39.8 degrees C =
313.0 degrees KFreezing point: -142 degrees F = -96.7 degrees C = 176.5
degrees KCritical temperature: 473 degrees F = 245 degrees C = 518
degrees K

Critical pressure: 895 psia = 60.8 atm = 6.17 MN/m(2)

Specific gravity: 1.322 at 20 degrees C (liquid)

Liquid surface tension: Not pertinent

Liquid water interfacial tension: Not pertinent

Vapor (gas) specific gravity: 2.9

Ratio of specific heats of vapor (gas): 1.199

Latent heat of vaporization: 142 Btu/lb = 78.7 cal/g = 3.30
K 10(5) J/kg

Heat of combustion: Not pertinent

Heat of decomposition: Not pertinent

Heat of solution: Not pertinent

Heat of polymerization: Not pertinent

Heat of fusion: 16.89 cal/g

Limiting value: Data not available

REID vapor pressure: 13.9 psia

Topic: CARBON DISULFIDE

OVERVIEW

Material name:

CARBON DISULFIDE

Common synonyms:

Carbon bisulfide

Characteristics:

Watery liquid Colorless to yellow Rotten egg to sweet odor

Sinks in water. Flammable, irritating vapor is produced.

Emergency actions:

Avoid contact with liquid and vapor. Keep people away.

Wear goggles, self-contained breathing apparatus and rubber overclothing

(including gloves).

Shut off ignition sources and call fire department.

Stop discharge if possible.

Stay upwind and use water spray to 'knock down' vapor.

Isolate and remove discharged material.

Notify local health and pollution control agencies.

Fire:

FLAMMABLE.

Flashback along vapor trail may occur.

Vapor may explode if ignited in an enclosed area.

Wear goggles, self-contained breathing apparatus, and rubber overclothing

(including gloves).

Extinguish with dry chemical or carbon dioxide.

Water and foam may be ineffective on fire.

Cool exposed containers with water.

Exposure:

CALL FOR MEDICAL AID.

VAPOR

Irritating to eyes, nose and throat.

If inhaled, will cause nausea, vomiting, difficult breathing, or loss of consciousness.

Move to fresh air.

If breathing has stopped, give artificial respiration.

If breathing is difficult, give oxygen.

LIQUID

Will burn skin and eyes.

Harmful if swallowed.

Remove contaminated clothing and shoes.

Flush affected areas with plenty of water.

IF IN EYES, hold eyelids open and flush with plenty of water.

IF SWALLOWED and victim is CONSCIOUS, have victim drink water

or milk and have victim induce vomiting.

IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water pollution:

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.

May be dangerous if it enters water intakes.

Notify local health and wildlife officials.

Notify operators of nearby water intakes.

Topic: CARBON DISULFIDE

RESPONSE TO DISCHARGE

Issue warning-high flammability Restrict access Evacuate area

LABEL

Category: Flammable liquid

Class: 3

CHEMICAL DESIGNATIONS

CG compatibility class: Carbon disulfide

Formula: CS(2)

IMO/UN designation: 3.1/1131

DOT id no.: 1131

CAS registry no.: 75-15-0

OBSERVABLE CHARACTERISTICS

Physical state: Liquid

Color: Colorless

Odor: Faint sweetish; disagreeable; offensive, like that of decaying cabbage

HEALTH HAZARDS

Personal protective equipment: Only self-contained breathing mask with full face, approved by the United States Bureau of Mines, is recommended. If the vapor concentration exceeds 2% by volume or is unknown, supplied-air respiratory equipment of appropriate design with full face masks should be used by all persons entering contaminated area. Masks should be used only for emergency situations and should be located accordingly. Almost any type of industrial clothing is satisfactory. Splashes of small quantity are not harmful to fabrics, and evaporation from clothing is quite rapid. Clothing should, however, be removed and the skin washed with water. Goggles should be used when there is any danger of CS(2) splashes or spray.

Symptoms following exposure: ACUTE EXPOSURE: mild to moderate irritation of skin, eyes, and mucous membranes from liquid or concentrated vapors; headache, garlicky breath, nausea, vomiting, diarrhea (even after vapor exposures), and occasionally abdominal pain; weak pulse, palpitations; fatigue, weakness in the legs, unsteady gait, vertigo; mania, hallucinations of sight, hearing, taste, and smell in acute, massive vapor exposures; central nervous depression with respiratory paralysis; death may occur during coma or after a convulsion.

Treatment of exposure: INHALATION: remove victim promptly from contaminated area. Administer oxygen and artificial respiration if needed. SKIN CONTACT: wash affected areas with copious quantities of water. INGESTION: induce vomiting and follow with gastric lavage and saline cathartics.

Threshold limit value: 10 ppm

Short term inhalation limits: 200 ppm for 10 minutes, 100 ppm for 30 minutes and 50 ppm for 60 minutes.

Toxicity by ingestion: Grade 2; rat LD(50) = 0.1 - 0.99 g/kg

Late toxicity: Non-specific liver cell damage in rats; higher incidence of upper respiratory disease in humans.

Vapor (gas) irritant characteristics: Vapors cause moderate

Topic: CARBON DISULFIDE

irritation such that personnel will find high concentrations unpleasant. The effect is temporary.

Liquid or solid irritant characteristics: Causes smarting of the skin and first-degree burns on short exposure and may cause secondary burns on long exposure.

Odor threshold: 0.21 ppm

IDLH value: 500 ppm

FIRE HAZARDS

Flash point: -22 degrees F C.C.

Flammable limits in air: 1.3%-50%

Fire extinguishing agents: Dry chemical, carbon dioxide

Fire extinguishing agents NOT to be used: Water and foam may be ineffective on fire.

Special hazards of combustion products: Toxic gases are generated; wear self-contained breathing apparatus.

Behavior in fire: Not pertinent

Ignition temperature: 212 degrees F

Electrical hazard: Contact of the liquid or vapor with the surface of a lighted electric light bulb could result in ignition.

Burning rate: 2.7 mm/min.

Adiabatic flame temperature: Data not available

Stoichiometric air to fuel ratio: Data not available

Flame temperature: Data not available

CHEMICAL REACTIVITY

Reactivity with water: No reaction

Reactivity with common materials: No reaction

Stability during transport: Stable

Neutralizing agents for acids and caustics: Not pertinent

Polymerization: Not pertinent

Inhibitor of polymerization: Not pertinent

Molar ratio (reactant to product): Data not available

Reactivity group: 38

WATER POLLUTION

Aquatic toxicity: 35 ppm/48 hr/mosquito fish/TLm/fresh water

Waterfowl toxicity: Data not available

Biological oxygen demand (BOD): Data not available

Food chain concentration potential: None

SHIPPING INFORMATION

Grades of purity: Commercial; technical; USP

Storage temperature: Ambient

Inert atmosphere: Inerted

Venting: Pressure-vacuum

HAZARD CLASSIFICATIONS

Code of federal regulations: Flammable liquid

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION:

Category	Rating
Fire.....	4*
Health	
Vapor Irritant.....	2
Liquid or Solid Irritant.....	2
Poisons.....	3
Water Pollution	
Human Toxicity.....	1

Topic: CARBON DISULFIDE

Aquatic Toxicity.....	2
Aesthetic Effect.....	3
Reactivity	
Other Chemicals.....	2
Water.....	0
Self Reaction.....	0

NFPA HAZARD CLASSIFICATION:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	3
Reactivity (Yellow).....	0

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C. and 1 ATM: Liquid
Molecular weight: 76.14
Boiling point at 1 ATM: 115 degrees F = 46.3 degrees C = 319.5 degrees K
Freezing point: -168.9 degrees F = -111.6 degrees C = 161.6 degrees K
Critical temperature: 523 degrees F = 273 degrees C = 546 degrees K
Critical pressure: 1100 psia = 76 atm = 7.7 MN/m(2)
Specific gravity: 1.26 at 20 degrees C (liquid)
Liquid surface tension: 32 dynes/cm = .032 N/m at 20 degrees C
Liquid water interfacial tension: 48.4 dynes/cm = .0484 N/m at 20 degrees C
Vapor (gas) specific gravity: 2.5
Ratio of specific heats of vapor (gas): 1.292
Latent heat of vaporization: 170 Btu/lb = 85 cal/g = 3.559 X 10(5) J/kg
Heat of combustion: -5814 Btu/lb = -3230 cal/g = -135.2 X 10(5) J/kg
Heat of decomposition: Not pertinent
Heat of solution: Not pertinent
Heat of polymerization: Not pertinent
Heat of fusion: 13.80 cal/g
Limiting value: Data not available
REID vapor pressure: 10.3 psia

Topic: 1,1-DICHLOROETHANE

OVERVIEW

Material name:

1,1-DICHLOROETHANE

Common synonyms:

Ethylidene chloride
Ethylidene dichloride
Chlorinated hydrochloric
ether

Characteristics:

Oily liquid Colorless Chloroform like ethereal
Sinks and mixes with water.

Emergency actions:

Wear goggles, self-contained breathing apparatus, and
rubber overclothing (including gloves).
Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire:

Flammable.
POISONOUS GAS MAY BE PRODUCED IN FIRE OR WHEN HEATED.
Containers may explode in fire.
Wear goggles and self-contained breathing apparatus.
Extinguish with alcohol foam, carbon dioxide, or dry
chemical.
Water may be ineffective on fire.

Exposure:

CALL FOR MEDICAL AID.

LIQUID

If swallowed may cause nausea, vomiting and faintness.
Irritating to skin and eyes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of
water.
IF SWALLOWED and victim is CONSCIOUS have victim drink
water or milk
and induce vomiting.

Water pollution:

Dangerous to aquatic life in high concentrations.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

RESPONSE TO DISCHARGE

Issue warning-high flammability. Restrict access. Chemical
and physical treatment.

LABEL

Category: None

Class: Not pertinent

CHEMICAL DESIGNATIONS

CG compatibility class: Halogenated hydrocarbon

Formula: $C_2H_4Cl_2$

IMO/UN designation: Not listed

DOT id no.: 2362

CAS registry no.: 75-34-3

Topic: 1,1-DICHLOROETHANE

OBSERVABLE CHARACTERISTICS

Physical state: Oily liquid

Color: Colorless

Odor: Chloroform

HEALTH HAZARDS

Personal protective equipment: In areas of poor ventilation or high concentration, a self-contained breathing apparatus with full face mask should be worn. Chemical workers goggles, rubber gloves, and protective clothing should be worn.

Symptoms following exposure: INHALATION: Irritation of respiratory tract. Salivation, sneezing, coughing, dizziness, nausea, and vomiting. EYES: Irritation, lacrimation, and reddening of conjunctiva. SKIN: Irritation. Prolonged or repeated skin contact can produce a slight burn. INGESTION: Ingestion incidental to industrial handling is not considered to be a problem. Swallowing of substantial amounts could cause nausea, vomiting, faintness, drowsiness, cyanosis, and circulatory failure.

Treatment of exposure: Call a doctor. INHALATION: Remove from contaminated area; keep warm and quiet. If breathing has stopped, give artificial respiration. Administer oxygen. EYES: Flush with large amounts of water or weak bicarbonate of soda solution. SKIN: Dilute with large amounts of water. Remove contaminated clothing. INGESTION: Attempt to empty stomach; dilute by administering fluids (tap water, soapy water, salt water, or milk).

Threshold limit value: 200 ppm.

Short term inhalation limits: 150 ppm.

Toxicity by ingestion: Grade 2; LD₅₀ = 0.5 to 5 g/kg (rat).

Late toxicity: Chronic exposure may cause liver damage and dermatitis. Animal experimentation has shown this compound to be slightly embryo-toxic and to retard fetal development.

Vapor (gas) irritant characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.

Liquid or solid irritant characteristics: Minimum hazard.

If spilled on clothing and allowed to remain, may cause smarting and reddening of skin.

Odor threshold: Data not available

IDLH value: 4,000 ppm

FIRE HAZARDS

Flash point: 57 degrees F O.C. = 22 degrees F C.C.

Flammable limits in air: 5.6% to 11.4%

Fire extinguishing agents: Alcohol foam, water, foam, CO₂, dry chemical, carbon tetrachloride

Fire extinguishing agents NOT to be used: Water may be ineffective

Special hazards of combustion products: When heated to decomposition emits highly toxic fumes to phosgene.

Behavior in fire: Explosion hazard

Ignition temperature: 856 degrees F

Topic: 1,1-DICHLOROETHANE

Electrical hazard: Data not available
 Burning rate: Data not available
 Adiabatic flame temperature: Data not available
 Stoichiometric air to fuel ratio: Data not available
 Flame temperature: Data not available

CHEMICAL REACTIVITY

Reactivity with water: No reaction
 Reactivity with common materials: Data not available
 Stability during transport: Data not available
 Neutralizing agents for acids and caustics: Data not available
 Polymerization: Data not available
 Inhibitor of polymerization: Data not available
 Molar ratio (reactant to product): Data not available
 Reactivity group: 36

WATER POLLUTION

Aquatic toxicity: TLM (Marine pinperch) 250 to 275 mg/l
 24-hour TLM Brine shrimp: 320 mg/l 24-hour TLM Pinperch: 160 mg/l
 Waterfowl toxicity: Data not available
 Biological oxygen demand (BOD): Percent, 0.05 g/g for 10 days Percent, 0.002 g/g for 5 days
 Food chain concentration potential: Data not available

SHIPPING INFORMATION

Grades of purity: Data not available
 Storage temperature: Cool
 Inert atmosphere: Data not available
 Venting: Data not available

HAZARD CLASSIFICATIONS

Code of federal regulations: Not listed
 NAS hazard rating for bulk water transportation: Not listed

NFPA HAZARD CLASSIFICATION:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	3
Reactivity (Yellow).....	0

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C. and 1 ATM: Liquid
 Molecular weight: 98.97
 Boiling point at 1 ATM: 135.14 degrees F = 57.3 degrees C = 230.5 degrees K
 Freezing point: -143.32 degrees F = -97.4 degrees C = 175.75 degrees K
 Critical temperature: 502.7 degrees F = 261.5 degrees C = 534.65 degrees K
 Critical pressure: 734.8 psia = 50 atm = 5.065 MN/m(2)
 Specific gravity: 1.174 at 20 degrees C
 Liquid surface tension: 24.75 dynes/cm = 0.02475 N/m at 20 degrees C
 Liquid water interfacial tension: Data not available
 Vapor (gas) specific gravity: 3.42
 Ratio of specific heats of vapor (gas): 1.136 at 20 degrees C (68 degrees F)
 Latent heat of vaporization: 131.6 Btu/lb = 73.1 cal/g = 3.06 X 10(5) J/kg

Topic: 1,1-DICHLOROETHANE

Heat of combustion: $-4,774 \text{ Btu/lb} = -2,652 \text{ cal/g} = -111 \times 10^5 \text{ J/kg}$

Heat of decomposition: Data not available

Heat of solution: Data not available

Heat of polymerization: Data not available

Heat of fusion: Data not available

Limiting value: Data not available

REID vapor pressure: 7.35 psia

Topic: CARBON TETRACHLORIDE

OVERVIEW

Material name:

CARBON TETRACHLORIDE

Common synonyms:

Carbon Tet

Tetrachloromethane

Benzinoform

Necatorina

Perchloromethane

Characteristics:

Watery liquid Colorless Sweet odor

Sinks in water. Poisonous vapor is produced.

Emergency actions:

Avoid contact with liquid and vapor. Keep people away.

Wear goggles and self-contained breathing apparatus.

Stop discharge if possible.

Stay upwind and use water spray to 'knock down' vapor.

Notify local health and pollution control agencies.

Fire:

Not flammable.

POISONOUS AND IRRITATING GASES ARE PRODUCED WHEN HEATED.

Wear goggles and self-contained breathing apparatus.

Exposure:

CALL FOR MEDICAL AID.

VAPOR

POISONOUS IF INHALED.

Irritating to eyes

Move to fresh air.

If breathing has stopped, give artificial respiration.

If breathing is difficult, give oxygen.

LIQUID

POISONOUS IF SWALLOWED.

Irritating to skin and eyes.

Remove contaminated clothing and shoes.

Flush affected areas with plenty of water.

IF IN EYES, hold eyelids open and flush with plenty of water.

IF SWALLOWED and victim is CONSCIOUS, have victim drink water

or milk and have victim induce vomiting.

IF SWALLOWED and victim is UNCONSCIOUS OR HAVING

CONVULSIONS, do nothing except keep victim warm.

Water pollution:

Effect of low concentrations on aquatic life is unknown.

May be dangerous if it enters water intakes.

Notify local health and pollution control officials.

Notify operators of nearby water intakes.

RESPONSE TO DISCHARGE

Issue warning-poison Restrict access Should be removed

LABEL

Category: None

Class: Not pertinent

CHEMICAL DESIGNATIONS

CG compatibility class: Halogenated hydrocarbon

Formula: CCl₄

Topic: CARBON TETRACHLORIDE

IMO/UN designation: 6.1/1846

DOT id no.: 1846

CAS registry no.: 56-23-5

OBSERVABLE CHARACTERISTICS

Physical state: Liquid

Color: Colorless

Odor: Sweetish, aromatic; moderately strong ethereal;
somewhat resembling that of chloroform.

HEALTH HAZARDS

Personal protective equipment: Organic vapor canister with
full face mask; protective clothing; rubber gloves.Symptoms following exposure: Dizziness, incoordination,
anesthesia; may be accompanied by nausea and liver damage.
Kidney damage also occurs, often producing decrease or
stopping of urinary output.Treatment of exposure: EYES AND SKIN: flush with plenty of
water; for eyes, get medical attention. Remove contaminated
clothing and wash before reuse. INHALATION: immediately
remove to fresh air, keep patient warm and quiet and get
medical attention promptly. Start artificial respiration if
breathing stops. INGESTION: induce vomiting and get medical
attention promptly. No specific antidote known.

Threshold limit value: 5 ppm

Short term inhalation limits: 25 ppm for 30 min.

Toxicity by ingestion: Grade 2; LD(50) = 0.5 to 5 g/kg
(rat)Late toxicity: Causes severe liver damage and death if
ingested.Vapor (gas) irritant characteristics: Vapors cause moderate
irritation such that personnel will find high
concentrations unpleasant. The effect is temporary.Liquid or solid irritant characteristics: Minimum hazard.
If spilled on clothing and allowed to remain, may cause
smarting and reddening of the skin.

Odor threshold: Greater than 10 ppm

IDLH value: 300 ppm

FIRE HAZARDS

Flash point: Not flammable

Flammable limits in air: Not flammable

Fire extinguishing agents: Not pertinent

Fire extinguishing agents NOT to be used: Not pertinent

Special hazards of combustion products: Forms poisonous
phosgene gas when exposed to open flames.

Behavior in fire: Decomposes to form chlorine and phosgene

Ignition temperature: Not flammable

Electrical hazard: Not pertinent

Burning rate: Not flammable

Adiabatic flame temperature: Data not available

Stoichiometric air to fuel ratio: Data not available

Flame temperature: Data not available

CHEMICAL REACTIVITY

Reactivity with water: No reaction

Reactivity with common materials: No reaction

Stability during transport: Stable

Neutralizing agents for acids and caustics: Not pertinent

Topic: CARBON TETRACHLORIDE

Polymerization: Not pertinent

Inhibitor of polymerization: Not pertinent

Molar ratio (reactant to product): Data not available

Reactivity group: 36

WATER POLLUTION

Aquatic toxicity: Data not available

Waterfowl toxicity: Data not available

Biological oxygen demand (BOD): None

Food chain concentration potential: None

SHIPPING INFORMATION

Grades of purity: Commercial; technical; USP

Storage temperature: Ambient

Inert atmosphere: No requirement

Venting: Pressure-vacuum

HAZARD CLASSIFICATIONS

Code of federal regulations: ORM-A

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION:

Category	Rating
Fire.....	0
Health	
Vapor Irritant.....	2
Liquid or Solid Irritant.....	1
Poisons.....	4
Water Pollution	
Human Toxicity.....	2
Aquatic Toxicity.....	2
Aesthetic Effect.....	2
Reactivity	
Other Chemicals.....	1
Water.....	0
Self Reaction.....	0

NFPA HAZARD CLASSIFICATION:

Category	Classification
Health Hazard (Blue).....	3
Flammability (Red).....	0
Reactivity (Yellow).....	0

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C. and 1 ATM: Liquid

Molecular weight: 153.83

Boiling point at 1 ATM: 170 degrees F = 76.5 degrees C = 349.7 degrees K

Freezing point: -9.4 degrees F = -23.0 degrees C = 250.2 degrees K

Critical temperature: 541 degrees F = 283 degrees C = 556 degrees K

Critical pressure: 660 psia = 45 atm = 4.6 MN/m(2)

Specific gravity: 1.59 at 20 degrees C (liquid)

Liquid surface tension: 27.0 dynes/cm = 0.027 N/m at 20 degrees C

Liquid water interfacial tension: 45.0 dynes/cm = 0.045 N/m at 20 degrees C

Vapor (gas) specific gravity: 5.3

Ratio of specific heats of vapor (gas): 1.111

Latent heat of vaporization: 84.2 Btu/lb = 46.8 cal/g = 1.959 X 10(5) J/kg

Topic: CARBON TETRACHLORIDE

Heat of combustion: Not pertinent
Heat of decomposition: Not pertinent
Heat of solution: Not pertinent
Heat of polymerization: Not pertinent
Heat of fusion: 5.09 cal/g
Limiting value: Data not available
REID vapor pressure: 3.8 psia

Topic: VINYLIDENE CHLORIDE

OVERVIEW

Material name:

VINYLIDENE CHLORIDE

Common synonyms:

1. 1-Dichloroethylene
unsym-Dichloroethylene

Characteristics:

Watery liquid Colorless Sweet odor

Sinks in water. Flammable, irritating vapor is produced.

Boiling point is 89 degrees F.

Emergency actions:

Avoid contact with liquid and vapor. Keep people away.

Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).

Shut off ignition sources and call fire department.

Stop discharge if possible.

Stay upwind and use water spray to "knock down" vapor.

Evacuate area in case of large discharge.

Isolate and remove discharged material.

Notify local health and pollution control agencies.

Fire:

FLAMMABLE.

POISONOUS GAS IS PRODUCED IN FIRE.

Containers may explode in fire.

Flashback along vapor trail may occur.

Vapor may explode if ignited in an enclosed area.

Wear self-contained breathing apparatus.

Combat fires from safe distance or protected location.

Extinguish with dry chemical, foam, or carbon dioxide.

Cool exposed containers with water.

Exposure:

CALL FOR MEDICAL AID.

VAPOR

Irritating to eyes, nose, and throat.

If inhaled, will cause dizziness or difficult breathing.

Move to fresh air.

If breathing has stopped, give artificial respiration.

If breathing is difficult, give oxygen.

LIQUID

Will burn skin and eyes.

Harmful if swallowed.

Remove contaminated clothing and shoes.

Flush affected areas with plenty of water.

IF IN EYES, hold eyelids open and flush with plenty of water.

IF SWALLOWED and victim is CONSCIOUS, have victim drink water

or milk.

Water pollution:

Effect of low concentrations on aquatic life is unknown.

May be dangerous if it enters water intakes.

Notify local health and wildlife officials.

Notify operators of nearby water intakes.

RESPONSE TO DISCHARGE

Issue warning-high flammability Evacuate area.

Topic: VINYLIDENE CHLORIDE

LABEL

Category: Flammable liquid

Class: 3

CHEMICAL DESIGNATIONS

CG compatibility class: Vinyl halides

Formula: $\text{CH}_2=\text{CCl}_2$

IMO/UN designation: 3.1/1303

DOT id no.: 1303

CAS registry no.: 75-35-4

OBSERVABLE CHARACTERISTICS

Physical state: Liquid

Color: Colorless

Odor: Sweet; like carbon tetrachloride or chloroform

HEALTH HAZARDS

Personal protective equipment: Approved canister or air-supplied mask; goggles or face shield; rubber gloves and boots.

Symptoms following exposure: Vapor can cause dizziness and drunkenness; high levels cause anesthesia. Liquid irritates eyes and skin.

Treatment of exposure: INHALATION: if any illness develops, remove person to fresh air promptly, keep warm and quiet, and get medical attention; if breathing stops, start artificial respiration. INGESTION: not likely a problem; no known antidote; treat symptomatically. EYES OR SKIN: flush with plenty of water for at least 15 min; get medical attention for eyes; remove contaminated clothing and wash before reuse.

Threshold limit value: 10 ppm

Short term inhalation limits: Data not available

Toxicity by ingestion: Grade 3; Oral LD(50) = 24 hr = 84 mg/kg (adrenalectomized rat)

Late toxicity: Data not available

Vapor (gas) irritant characteristics: Vapors cause moderate irritation such that personnel will find high concentrations unpleasant. The effect is temporary.

Liquid or solid irritant characteristics: Causes smarting of the skin and first-degree burns on short exposure; may cause secondary burns on long exposure.

Odor threshold: Data not available

IDLH value: Data not available

FIRE HAZARDS

Flash point: 0 degrees F O.C.

Flammable limits in air: 7.3%-16.0%

Fire extinguishing agents: Foam, carbon dioxide, dry chemical

Fire extinguishing agents NOT to be used: Water may be ineffective.

Special hazards of combustion products: Toxic hydrogen chloride and phosgene are generated in fires.

Behavior in fire: May explode in fire due to polymerization. Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back.

Ignition temperature: 955-1031 degrees F

Topic: VINYLIDENE CHLORIDE

Electrical hazard: Not pertinent

Burning rate: 2.7 mm/min.

Adiabatic flame temperature: Data not available

Stoichiometric air to fuel ratio: Data not available

Flame temperature: Data not available

CHEMICAL REACTIVITY

Reactivity with water: No reaction

Reactivity with common materials: Copper and aluminum can cause polymerization.

Stability during transport: Stable

Neutralizing agents for acids and caustics: Not pertinent

Polymerization: Can occur if exposed to sunlight, air, copper, aluminum, heat.

Inhibitor of polymerization: 200 ppm methyl ether of hydroquinone; 0.6-0.8% phenol

Molar ratio (reactant to product): Data not available

Reactivity group: 35

WATER POLLUTION

Aquatic toxicity: Data not available

Waterfowl toxicity: Data not available

Biological oxygen demand (BOD): Data not available

Food chain concentration potential: None

SHIPPING INFORMATION

Grades of purity: 99%

Storage temperature: Ambient

Inert atmosphere: Padded

Venting: Pressure-vacuum

HAZARD CLASSIFICATIONS

Code of federal regulations: Flammable liquid

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION:

Category	Rating
Fire.....	3
Health	
Vapor Irritant.....	2
Liquid or Solid Irritant.....	2
Poisons.....	3
Water Pollution	
Human Toxicity.....	0
Aquatic Toxicity.....	2
Aesthetic Effect.....	2
Reactivity	
Other Chemicals.....	2
Water.....	0
Self Reaction.....	3

NFPA HAZARD CLASSIFICATION:

Category	Classification
Health Hazard (Blue).....	1
Flammability (Red).....	4
Reactivity (Yellow).....	2

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C. and 1 ATM: Liquid

Molecular weight: 96.95

Boiling point at 1 ATM: 88.9 degrees F = 31.6 degrees C = 304.8 degrees K

Freezing point: -187.6 degrees F = 122.0 degrees C = 151.2

Topic: VINYLIDENE CHLORIDE

degrees K

Critical temperature: Not pertinent

Critical pressure: Not pertinent

Specific gravity: 1.21 at 20 degrees C (liquid)

Liquid surface tension: 24 dynes/cm = 0.024 N/m at 15
degrees CLiquid water interfacial tension: 37 dynes/cm = 0.037 N/m
at 22.7 degrees C

Vapor (gas) specific gravity: 3.3

Ratio of specific heats of vapor (gas): Data not available

Latent heat of vaporization: 130 Btu/lb = 72 cal/g = 3.0 X
10(5) J/kgHeat of combustion: -4860 Btu/lb = -2700 cal/g = -113.0 X
10(5) J/kg

Heat of decomposition: Not pertinent

Heat of solution: Not pertinent

Heat of polymerization: -333 Btu/lb = -185 cal/g = -7.75 X
10(5) J/kg

Heat of fusion: Data not available

Limiting value: Data not available

REID vapor pressure: 18.3 psia

Topic: 1,2-DICHLOROETHYLENE

OVERVIEW

Material name:

1,2-DICHLOROETHYLENE

Common synonyms:

Acetylene dichloride

sym-dichloroethylene

Dioform

cis-1, 2-dichloroethylene

trans-1, 2-dichloroethylene

Characteristics:

Liquid Colorless Sweet pleasant odor

Sinks in water. Flammable, irritating vapor is produced.

Emergency actions:

Wear goggles and self-contained breathing apparatus.

Shut off ignition sources. Call fire department.

Stop discharge if possible. Keep people away.

Isolate and remove discharged material.

Notify local health and pollution control agencies.

Fire:

FLAMMABLE.

POISONOUS GASES MAY BE PRODUCED IN FIRE.

Containers may explode in fire.

Flashback along vapor trail may occur.

Vapor may explode if ignited in an enclosed area.

Extinguish with dry chemicals, foam or carbon dioxide.

Water may be ineffective on fire.

Cool exposed containers with water.

Exposure:

Call for medical aid.

VAPOR

If inhaled will cause dizziness, nausea, vomiting, or difficult breathing.

Move victim to fresh air.

If breathing has stopped, give artificial respiration.

If breathing is difficult, give oxygen.

LIQUID

Harmful if swallowed.

IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water pollution:

Effect of low concentrations on aquatic life is unknown.

May be dangerous if it enters water intakes.

Notify local health and wildlife officials.

Notify operators of nearby water intakes.

RESPONSE TO DISCHARGE

Issue warning-high flammability Restrict access Evacuate area Should be removed Chemical and physical treatment

LABEL

Category: Flammable liquid

Class: 3

CHEMICAL DESIGNATIONS

CG compatibility class: Not listed

Formula: ClCH = CHCl

IMO/UN designation: 3.2/1150

Topic: 1,2-DICHLOROETHYLENE

DOT id no.: 1150

CAS registry no.: 540-59-0

OBSERVABLE CHARACTERISTICS

Physical state: Liquid

Color: Colorless

Odor: Ethereal, slightly acrid; pleasant, chloroform-like

HEALTH HAZARDS

Personal protective equipment: Rubber gloves; safety goggles; air supply mask or self-contained breathing apparatus.

Symptoms following exposure: Inhalation causes nausea, vomiting, weakness, tremor, epigastric cramps, central nervous depression. Contact with liquid causes irritation of eyes and (on prolonged contact) skin. Ingestion causes slight depression to deep narcosis.

Treatment of exposure: INHALATION: remove from further exposure; if breathing is difficult, give oxygen; if victim is not breathing, give artificial respiration, preferably mouth-to-mouth; give oxygen when breathing is resumed; call a physician. EYES: flush with water for at least 15 min. SKIN: wash well with soap and water. INGESTION: give gastric lavage and cathartics.

Threshold limit value: 200 ppm

Short term inhalation limits: Data not available

Toxicity by ingestion: Grade 2; oral LD(50) = 770 mg/kg (rat)

Late toxicity: Produces liver and kidney injury in experimental animals

Vapor (gas) irritant characteristics: Data not available

Liquid or solid irritant characteristics: Data not available

Odor threshold: Data not available

IDLH value: 4,000 ppm

FIRE HAZARDS

Flash point: 37 degrees F C.C.

Flammable limits in air: 9.7%-12.8%

Fire extinguishing agents: Dry chemical, foam, carbon dioxide

Fire extinguishing agents NOT to be used: Water may be ineffective.

Special hazards of combustion products: Phosgene and hydrogen chloride fumes may form in fires.

Behavior in fire: Vapor is heavier than air and may travel a considerable distance to a source of ignition and flash back.

Ignition temperature: 860 degrees F

Electrical hazard: Data not available

Burning rate: 2.6 mm/min.

Adiabatic flame temperature: Data not available

Stoichiometric air to fuel ratio: Data not available

Flame temperature: Data not available

CHEMICAL REACTIVITY

Reactivity with water: No reaction

Reactivity with common materials: No reaction

Stability during transport: Stable

Topic: 1,2-DICHLOROETHYLENE

Neutralizing agents for acids and caustics: Not pertinent
 Polymerization: Will not occur under ordinary conditions of shipment. The reaction is not vigorous.
 Inhibitor of polymerization: None used
 Molar ratio (reactant to product): Data not available
 Reactivity group: Data not available

WATER POLLUTION

Aquatic toxicity: Data not available
 Waterfowl toxicity: Data not available
 Biological oxygen demand (BOD): Data not available
 Food chain concentration potential: None

SHIPPING INFORMATION

Grades of purity: Commercial
 Storage temperature: Ambient
 Inert atmosphere: No requirement
 Venting: Pressure-vacuum

HAZARD CLASSIFICATIONS

Code of federal regulations: Flammable liquid
 NAS hazard rating for bulk water transportation: Not listed

NFPA HAZARD CLASSIFICATION:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	3
Reactivity (Yellow).....	2

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C. and 1 ATM: Liquid
 Molecular weight: 97.0
 Boiling point at 1 ATM: cis: 140 degrees F = 60 degrees C = 333 degrees K
 trans: 118 degrees F = 48 degrees C = 321 degrees K
 Freezing point: cis: -114 degrees F = -81 degrees C = 192 degrees K
 trans: -58 degrees F = -50 degrees C = 223 degrees K
 Critical temperature: Not pertinent
 Critical pressure: Not pertinent
 Specific gravity: 1.27 at 25 degrees C (liquid)
 Liquid surface tension: 24 dynes/cm = 0.024 N/m at 20 degrees C
 Liquid water interfacial tension: (est.) 30 dynes/cm = 0.030 N/m at 20 degrees C
 Vapor (gas) specific gravity: 3.34
 Ratio of specific heats of vapor (gas): 1.1468
 Latent heat of vaporization: 130 Btu/lb = 72 cal/g = 3.0 X 10(5) J/kg
 Heat of combustion: -4,847.2 Btu/lb = -2,692.9 cal/g = -112.67 X 10(5) J/kg
 Heat of decomposition: Not pertinent
 Heat of solution: Not pertinent
 Heat of polymerization: Not pertinent
 Heat of fusion: Data not available
 Limiting value: Data not available
 Reid vapor pressure: Data not available

Topic: TRICHLOROETHYLENE

OVERVIEW

Material name: TRICHLOROETHYLENE

Common synonyms:

Trichloroethylene
Triclene; Algylen
Chlorylen
Gemalgene
Trethylene
Trichloran; Trilene

Characteristics:

Watery liquid Colorless Sweet odor
Sinks in water. Irritating vapor is produced.

Emergency actions:

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire:

Combustible.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, carbon dioxide, or foam.

Exposure:

CALL FOR MEDICAL AID.

VAPOR

Irritating to eyes, nose and throat.
If inhaled, will cause nausea, vomiting, difficult breathing,
or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID

Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, difficult breathing,
or loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water
or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water pollution:

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

RESPONSE TO DISCHARGE

Should be removed Chemical and physical treatment

Topic: TRICHLOROETHYLENE

LABEL

Category: None
Class: Not pertinent

CHEMICAL DESIGNATIONS

CG compatibility class: Halogenated hydrocarbon
Formula: CHCl=CCl(2)
IMO/UN designation: 9.0/1710
DOT id no.: 1710
CAS registry no.: 79-01-6

OBSERVABLE CHARACTERISTICS

Physical state: Liquid
Color: Colorless
Odor: Chloroform-like; ethereal

HEALTH HAZARDS

Personal protective equipment: Organic vapor-acid gas canister; self-contained breathing apparatus for emergencies; neoprene or vinyl gloves; chemical safety goggles; face-shield; neoprene safety shoes; neoprene suit or apron for splash protection.

Symptoms following exposure: INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation.

Treatment of exposure: Do NOT administer adrenalin or epinephrine; get medical attention for all cases of overexposure. INHALATION: remove victim to fresh air; if necessary, apply artificial respiration and/or administer oxygen. INGESTION: have victim drink water and induce vomiting; repeat three times; then give 1 tablespoon epsom salts in water. EYES: flush thoroughly with water. SKIN: wash thoroughly with soap and warm water.

Threshold limit value: 50 ppm

Short term inhalation limits: 200 ppm for 30 min.

Toxicity by ingestion: Grade 3; LD(50) = 50 to 500 mg/kg

Late toxicity: Data not available

Vapor (gas) irritant characteristics: Vapors cause a slight smarting of the eyes or respiratory system if present in high concentrations. The effect is temporary.

Liquid or solid irritant characteristics: Minimum hazard.

If spilled on clothing and allowed to remain, may cause smarting and reddening of the skin.

Odor threshold: 50 ppm

IDLH value: 1,000 ppm

FIRE HAZARDS

Flash point: 90 degrees F C.C.; practically nonflammable

Flammable limits in air: 8.0%-10.5%

Fire extinguishing agents: Water fog

Fire extinguishing agents NOT to be used: Not pertinent

Special hazards of combustion products: Toxic and irritating gases are produced in fire situations.

Behavior in fire: Not pertinent

Topic: TRICHLOROETHYLENE

Ignition temperature: 770 degrees F
 Electrical hazard: Not pertinent
 Burning rate: Not pertinent
 Adiabatic flame temperature: Data not available
 Stoichiometric air to fuel ratio: Data not available
 Flame temperature: Data not available

CHEMICAL REACTIVITY

Reactivity with water: No reaction
 Reactivity with common materials: No reaction
 Stability during transport: Stable
 Neutralizing agents for acids and caustics: Not pertinent
 Polymerization: Not pertinent
 Inhibitor of polymerization: Not pertinent
 Molar ratio (reactant to product): Data not available
 Reactivity group: 35

WATER POLLUTION

Aquatic toxicity: 660 mg/l/40 hr/daphnia/kill/fresh water
 Waterfowl toxicity: Data not available
 Biological oxygen demand (BOD): Data not available
 Food chain concentration potential: None

SHIPPING INFORMATION

Grades of purity: Technical; dry cleaning; degreasing;
 extraction
 Storage temperature: Ambient
 Inert atmosphere: No requirement
 Venting: Pressure-vacuum

HAZARD CLASSIFICATIONS

Code of federal regulations: ORM-A

NAS HAZARD RATING FOR BULK WATER TRANSPORTATION:

Category	Rating
Fire.....	1
Health	
Vapor Irritant.....	1
Liquid or Solid Irritant.....	1
Poisons.....	2
Water Pollution	
Human Toxicity.....	1
Aquatic Toxicity.....	2
Aesthetic Effect.....	2
Reactivity	
Other Chemicals.....	1
Water.....	0
Self Reaction.....	1

NFPA HAZARD CLASSIFICATION:

Category	Classification
Health Hazard (Blue).....	2
Flammability (Red).....	1
Reactivity (Yellow).....	0

PHYSICAL AND CHEMICAL PROPERTIES

Physical state at 15 degrees C. and 1 ATM: Liquid
 Molecular weight: 131.39
 Boiling point at 1 ATM: 189 degrees F = 87 degrees C = 360
 degrees K
 Freezing point: -123.5 degrees F = -86.4 degrees C = 186.8
 degrees K

Topic: TRICHLOROETHYLENE

Critical temperature: Not pertinent

Critical pressure: Not pertinent

Specific gravity: 1.46 at 20 degrees C (liquid)

Liquid surface tension: 29.3 dynes/cm = 0.0293 N/m at 20 degrees C

Liquid water interfacial tension: 34.5 dynes/cm = 0.0345 N/m at 24 degrees C

Vapor (gas) specific gravity: 4.5

Ratio of specific heats of vapor (gas): 1.116

Latent heat of vaporization: 103 Btu/lb = 57.2 cal/g = 2.4 X 10⁽⁵⁾ J/kg

Heat of combustion: Not pertinent

Heat of decomposition: Not pertinent

Heat of solution: Not pertinent

Heat of polymerization: Not pertinent

Heat of fusion: Data not available

Limiting value: Data not available

REID vapor pressure: 2.5 psia

**SITE SPECIFIC
HEALTH AND SAFETY PLAN**

Agreement for Services - ASC 89882WS

**OPERABLE UNIT NO. 2
GRANULAR ACTIVATED CARBON TREATMENT SYSTEM**

Prepared for:

**EG&G ROCKY FLATS, INC.
ROCKY FLATS PLANT
P.O. BOX 464
GOLDEN, COLORADO 80402-0464**

APRIL 5, 1991

Prepared by:

**RIEDEL ENVIRONMENTAL SERVICES, INC.
5850 East 58th Ave. Suite F
Commerce City, Colorado 80022**

1.0 INTRODUCTION

This plan establishes requirements and provides guidelines for worker safety and hazard identification during the installation of the Granular Activated Treatment System for the Operable Unit No. 2 located at the Rocky Flats Plant in Golden, Colorado. The purpose of this plan is to identify procedures for avoiding potential hazards from chemicals, equipment, or the environment, and for responding to serious injury or accident. No changes will be made to this plan without consent and approval by RES project manager and health and safety officer. These changes to be filed on HSP Field Change Forms in appendix A.

1.1 SITE DESCRIPTION

The OU2 is comprised of the 903 Pad, Mound, and East Trenches Areas which are located east-southeast of the RFP as shown in Figure 1. The areas of OU2 lie within either the South Walnut Creek or Woman Creek drainage basins. Twenty sites, designated as IHSSs, lie within OU2: five in the 903 Pad area, four in the Mound area, and 11 in the East Trenches area. RES will install a water treatment system in this area, but will not cross any IHSS sites.

The 903 Pad Area consists of the following IHSS sites:

1) 903 Drum Storage Site (#112) - Area used (during the 1950's and 1960's) for storage of drums containing cutting oils containing the following:

- Uranium
- mineral oil
- Carbon Tetrachloride
- Trichloroethene
- Tetrachloroethene
- Silicone Oils
- Acetone
- Ethanolamine

These drums were removed by 1968; the contaminated areas (resulting from leaking drums) were scraped into one area and capped with dirt and asphalt.

2) 903 Lip Site (#155) - Area contaminated by wind carried contaminants from the pad area.

3) Trench T-2 Site (#109) - Trenches used for disposal of sanitary sewage sludge and flattened uranium and plutonium contaminated drums.

4) Reactive Metal Destruction Site (#140) - Area previously used for destruction of lithium, sodium, calcium and magnesium metals and various organic solvents.

5) Gas Detoxification Site (#183) - Building 952 - used to detoxify bottled gases.

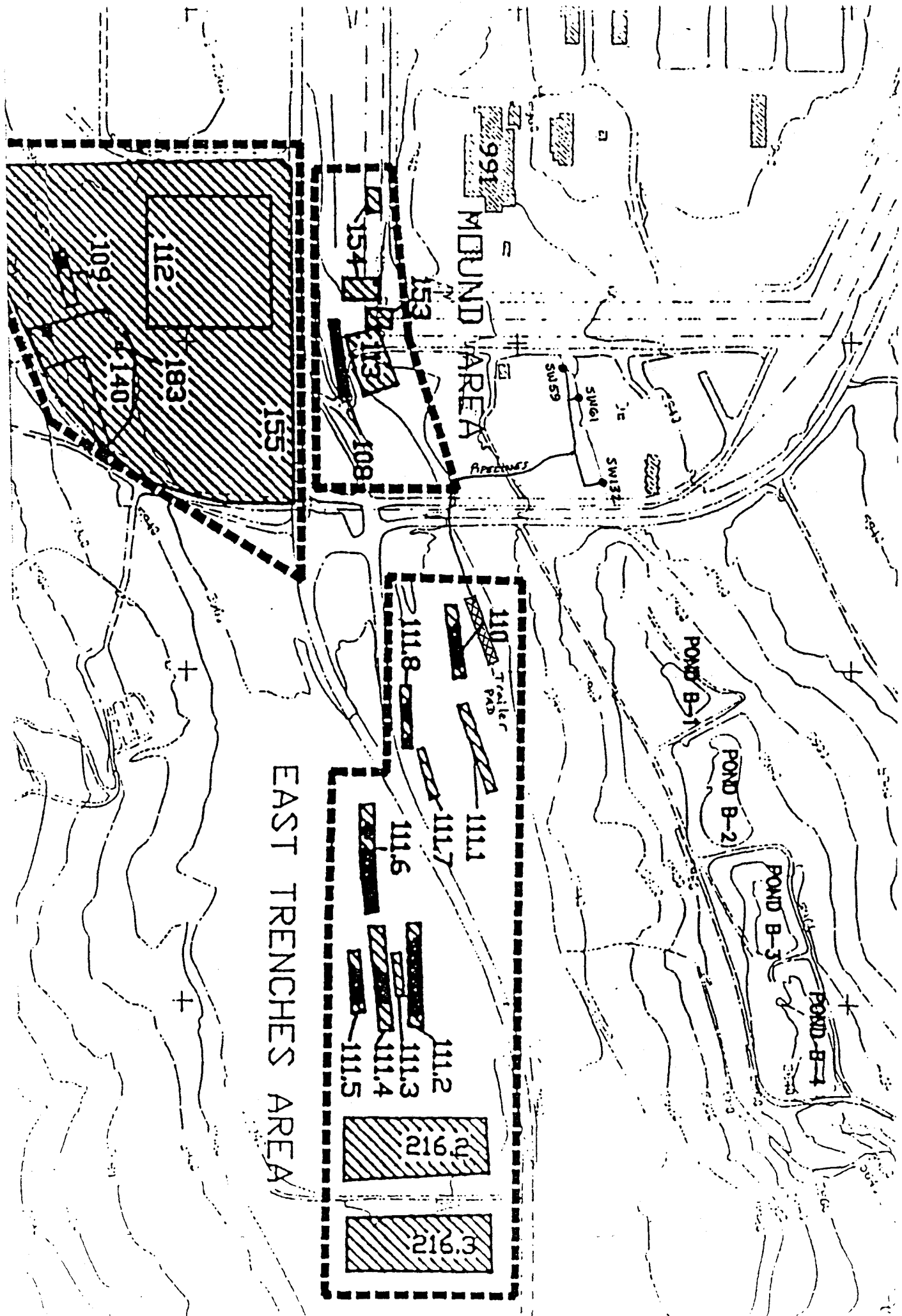


FIGURE 1 - IHS LOCATIONS

The Mound Area consists of the following IHSS sites:

- 1) Mound Site (#113) - Uranium, plutonium and solvent drum storage area. Area has been partially remediated.
- 2) Trench T-1 Site (#108) - Trench containing approximately 125 buried drums of depleted uranium and plutonium chips coated with lathe coolant.
- 3) Oil Burn Pit No. 2 Site (#153) - 2 trenches previously used for burning oil containing uranium.
- 4) Pallet Burn Site (#154) - Area used to burn pallets which might have been contaminated with solvent and/or radionuclides.

The East Trenches Area consists of 9 trenches which were previously used to dispose of depleted uranium, flattened depleted uranium and plutonium-contaminated drums and sanitary sludge. These may be found in figure 1 as follows:

- Trench T-3 - #110
- Trench T-4 - #111.1
- Trench T-5 - #111.2
- Trench T-6 - #111.3
- Trench T-7 - #111.4
- Trench T-8 - #111.5
- Trench T-9 - #111.6
- Trench T-10 - #111.7
- Trench T-11 - #111.8

Additionally, two (2) areas (#216.2 and #216.3) were used for spray irrigation of sewage treatment plant effluent.

Also present in the vicinity of the OU2 are six (6) Solid Waste Management Units (SWMU) (see Figure 2):

- 1) SWMU 121 Original Process Waste Lines - These are abandoned process effluent from the process areas at the facility. Potential groundwater contaminants are tetrachloroethylene, trichloroethylene, carbon tetrachloride, radionuclides, and nitrates.
- 2) SWMU 141 Sludge Dispersal Plume - This area is believed to have been impacted by wind dispersion of dried sludge from the Sewage Treatment Plant drying beds.
- 3) SWMU 142.5 Retention Pond B-1 - This pond was believed to have been contaminated by various wastes containing nitrates and low level radioactive waste.
- 4) SWMU 165 Triangle Area - This area was used from 1966 to 1975 for the storage of drums containing plutonium-

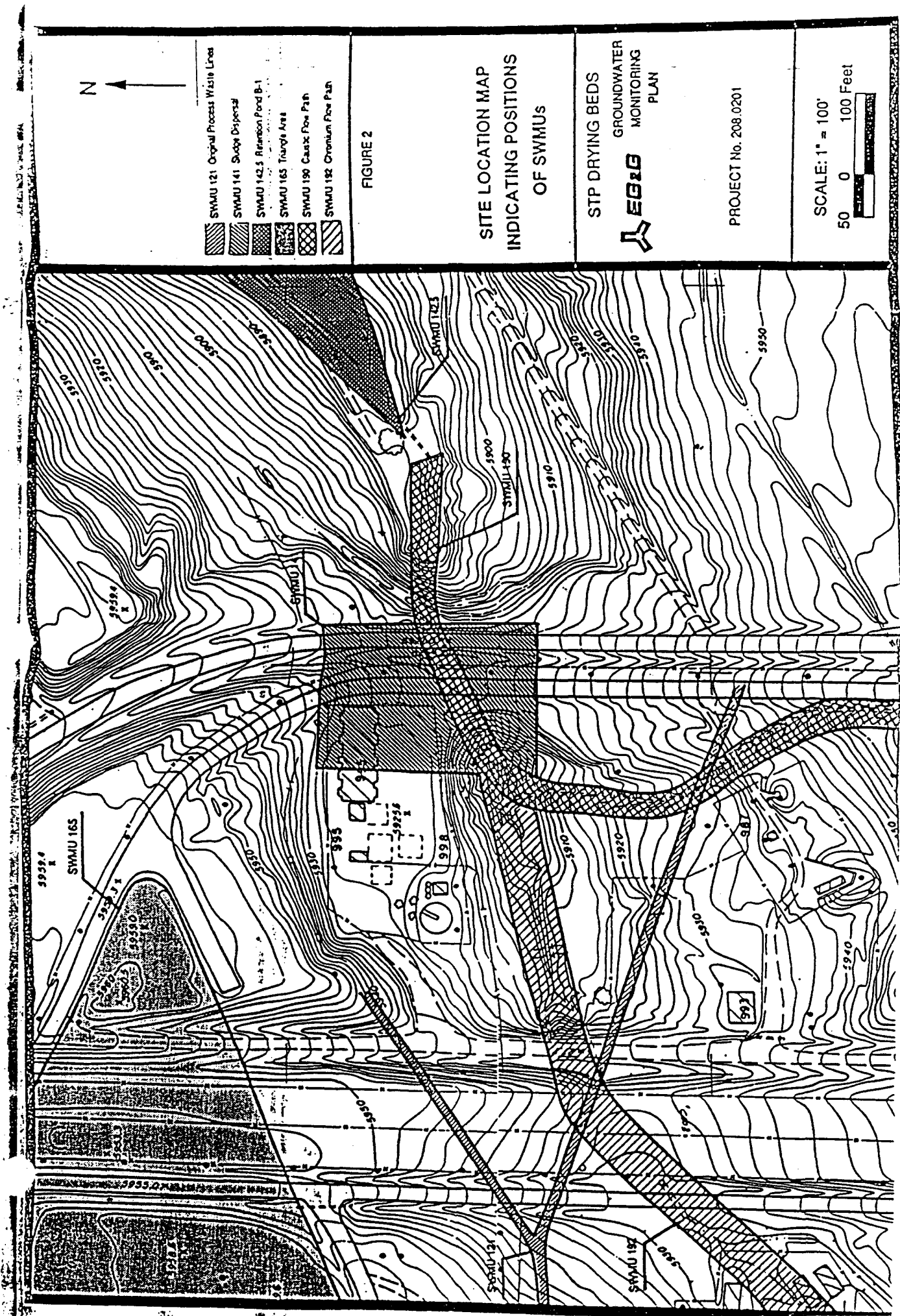


FIGURE 2 - SWMU LOCATIONS

contaminated wastes. These wastes have since been removed.

5) SWMU 190 Caustic Flow Path - This area was caused by a spill of caustic wastes near the steam plant (building 443). Snowmelt is believed to have transported potassium hydroxide (which had been neutralized) to Pond B-1.

6) SWMU 192 Chromium Flow Path - This area was caused by the transport of cooling-tower blowdown, which may have contained chromium-laden biocides, to Pond B-1.

RES will install water collection stations at SW59 and SW61 which are located in SWMU 192, Chromium Flow Path (see figures 2 and 3); no excavation will take place.

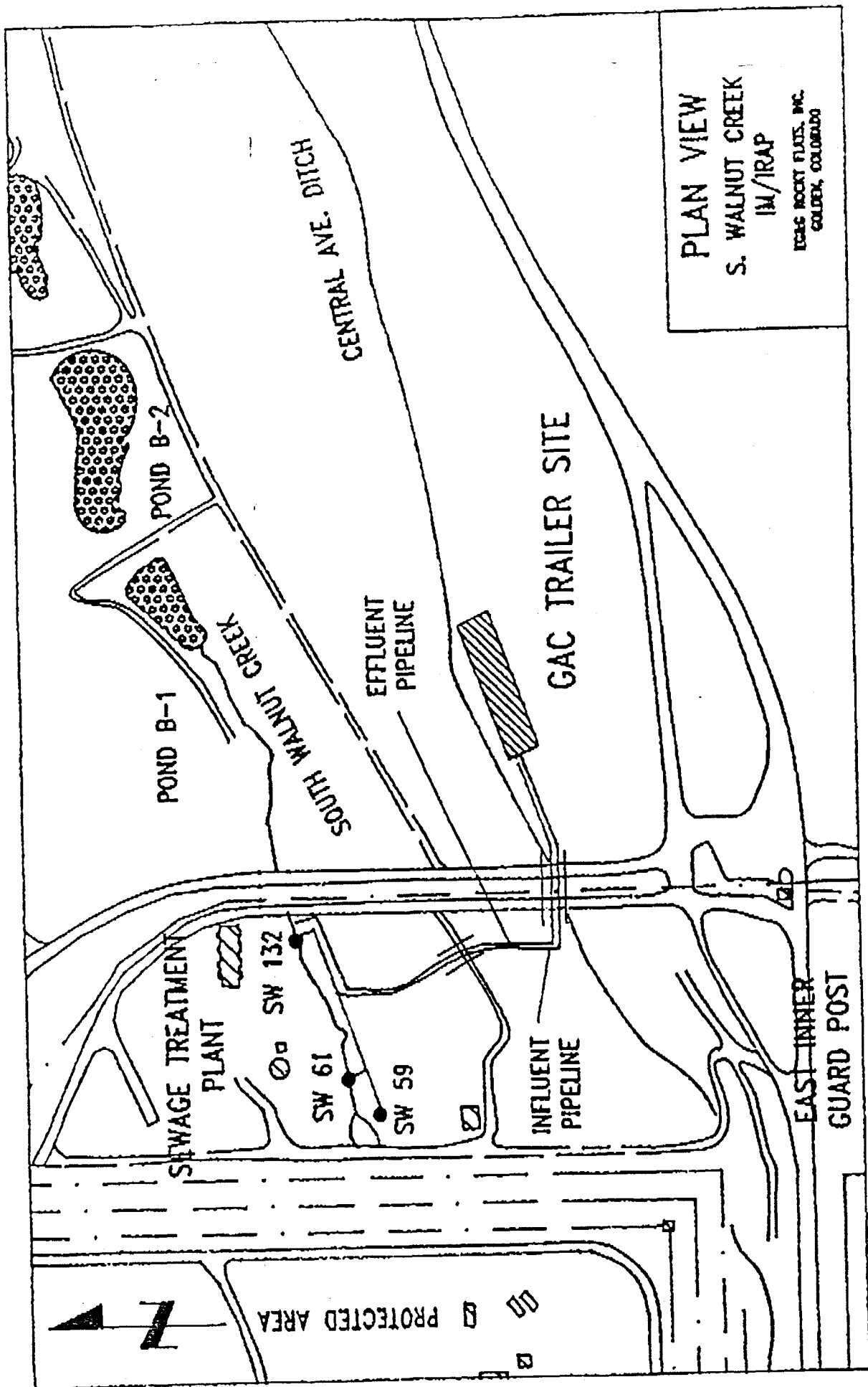


FIGURE 3 - GAC TREATMENT SYSTEM LOCATION

2.0 SCOPE OF WORK

As part of the Interim Remedial Action Plan for the Operable Unit Number 2, RES will design, build and set up at Rocky Flats a water filtration system which includes the following:

- 1) Collection System - catch basins in the field to collect water and pump it to storage tank,
- 2) Process System - three bag filters and four granular activated carbon (GAC) units to filter water of assorted hydrocarbons and chlorohydrocarbons,
- 3) Trailer - housing for process system and office,
- 4) Electrical System - support for alarms, process system, collection system and trailer.

These will be fabricated and installed during April and May, 1991 (see figure 3 for location and layout).

3.0 KEY PERSONNEL ASSIGNMENTS

3.1 EG&G PERSONNEL

<u>NAME</u>	<u>TITLE</u>	<u>EXTENSION</u>
J.E. Evered	E. R. Director	4934
T.C. Greengard	Remediation Programs Manager	7121
D.W. Pontius	IRA Manager	5536
D. Smith	E. R. H&S Officer	5958
J.R. Majestic	H&S Director, Deputy AGM	4707
F.J. Furman	Occupational Health Director	2895
C.E. Kennedy	Manager, Safety & Hygiene	4369
G. Shearer	H&S Area Manager	2755
Dina Sassong	H&S Liason Officer	5785
L.A. Doerr	Radiation Engineering Rep.	5151
B.P. Fielding	Site H&S Coordinator	7098

3.2 RES PERSONNEL

<u>NAME</u>	<u>TITLE</u>
Matt Wetzel	Project Manager
Gerald Marks	H&S Officer
David McClellan	Project Engineer
Frank Johnston	Project Foreman

The Project Manager will have overall responsibility for implementation of the site health and safety program.

The Health and Safety Officer will be responsible for application of the site health and safety plan to each task.

The Project Engineer will be responsible for the design and installation of the treatment system.

The Project Foreman will be responsible for on-site personnel assignments and task completion .

4.0 ONSITE WORKPLANS

The following tasks will be completed on RFP site for the installation of the OU2 system. These tasks will overlap, somewhat, but the sequence will be similar to the following:

1. Each weir will be installed without excavation (see QA Addendum). A steel box cover will be bolted to the tops of each weir to protect and contain the weir. A stainless steel submersible pump will be placed (free standing) inside.
2. The primary influent piping will be connected by using insert fittings. This pipe will be inserted into the secondary pipe, which is also connected using insert fittings. All secondary piping will be connected to the primary using rubber reducing fittings (except at the collection weirs). The system will periodically be pressure checked for leakage. The discharge pipeline will be constructed of schedule 80 PVC and pressure checked. Routing through the culvert will require cribbing with short lengths of channel stock placed laterally across the culvert to raise the pipelines from the bottom.
3. The pipelines will be heat traced, insulated, and covered with an aluminum skin secured by screws. The insulated piping will be supported above the ground with timber cribbing and anchored with tee posts.
4. The surge tank will be placed inside the containment tank and will be plumbed together. The tank will be centered on the pad and anchored in accordance with Rocky Flats Plant Standard SC-106, Rev. E for Important-Low Hazard Seismic Loading.
5. The trailer will be delivered and centered on a pad built by RES. The long and short sides of the trailer will be leveled independently, using 4 foot carpenters levels. Cables will be connected from the trailer to the tie-downs provided by EG&G; these will be tightened in accordance with Rocky Flats Plant Standard SC-106, Rev. E for Important-Low Hazard Seismic Loading.
6. The portable generator will be placed near the trailer and connected to its fuel supply (a 500 gallon double wall steel fuel tank).
7. The trailer will be plumbed to the surge tank. The collection and discharge pipelines will be plumbed to the surge tank and their respective submersible pumps.

8. The weirs, and all remaining piping will be heat traced, insulated and jacketed.
9. The electrician will wire the collection pumps, and heat tracing to the trailer's breaker panel. The breaker panel will be wired to the generator.
10. Final system inspection and check.
11. Acceptance test.

5.0 HAZARD EVALUATION

Installation of the OU2 GAC system will present the following potential hazards:

- 1) Physio-chemical - Various organic contaminants (see Table 1) exist in the water at SW59 and SW61 in low concentration; it is anticipated that these contaminants will not pose a respiratory threat to workers, however, precautions will be taken to avoid physical contact with these waters.
- 2) Biological Hazards - Bee sting and snakebite may pose a threat to workers on this site.
- 3) Radiological - Low level may be present in surrounding areas (25 pCi/gm Alpha and 36 pCi/gm Beta have been detected in the soils in the area) and in the water at SW59 and SW61 (Table 1); the immediate site will be sampled by EG&G prior to work to ensure that significant levels of radionuclides are not present.
- 4) Construction - typical hazards will include electrical shock, vehicular hazards, crane, and typical hand tool hazards.

5.1 SITE SPECIFIC HAZARDS

1. Low Level Radiation
This project does not involve handling of significantly high levels of radioactive material, but the potential to encounter radioactive materials exists from currently unknown sources. Any suspect material (i.e. does not belong to RES) should be treated with the likelihood of containing radioactive material and should not be handled without written authorization from EG&G. Additionally, any restricted areas should not be entered for any reason without proper authorization from EG&G. These restricted areas will be posted with proper labeling and barricaded. Items which display yellow media are to be considered containing radioactive materials and should not be handled by RES personnel. EG&G will provide TLD Badges for Riedels' personnel to be analyzed monthly as required by EG&G protocol. Riedel employee's will sign a statement for EG&G to release results of TLD Badges to Riedel. In addition EG&G personnel will make a daily sweep of the area for low level radiation during installation.
2. IHSS/SWMU
This phase of RES operations is not within IHSS areas. No SWMUs comprise the selected trailer site, but the collection stations will be placed on a SWMU area; the soil in this area will not be removed. RES personnel is directed not to enter or disturb soil within IHSS/SWMU boundaries.
3. Noise
Elevated noise levels may be encountered during filter changes from the purging of air from the vessels. A noise survey will

TABLE 1
SURFACE WATER QUALITY

	<u>UNITS</u>	<u>INFLUENT</u>	<u>EFFLUENT</u>
		<u>CONCENTRATION</u>	
<u>Organics</u>			
Vinyl Chloride	ug/l	11	NA
Methylene Chloride	ug/l	34	NA
Acetone	ug/l	99	NA
Carbon Disulfide	ug/l	5	5U
1,1-Dichloroethene	ug/l	127	5U
1,1-Dichloroethane	ug/l	6	5U
1,2-Dichloroethene	ug/l	10	5U
Carbon Tetrachloride	ug/l	249	5U
Trichloroethene	ug/l	298	5U
Tetrachloroethene	ug/l	235	5U
<u>Dissolved Metals</u>			
Antimony	mg/l	0.0607	NA
Beryllium	mg/l	0.0052	NA
Iron	mg/l	0.3476	NA
Manganese	mg/l	0.6073	NA
Selenium	mg/l	0.0063	NA
Strontium	mg/l	0.8772	NA
Tin	mg/l	0.7641	NA
<u>Total Metals</u>			
Aluminum	mg/l	24.0745	NA
Antimony	mg/l	0.645	NA
Barium	mg/l	1.5985	NA
Beryllium	mg/l	0.0439	NA
Cadmium	mg/l	0.0120	NA
Chromium	mg/l	0.1642	NA
Cobalt	mg/l	0.1105	NA
Copper	mg/l	0.2281	NA
Iron	mg/l	155.5478	NA
Lead	mg/l	0.1664	NA
Lithium	mg/l	0.5859	NA
Manganese	mg/l	2.8410	NA
Mercury	mg/l	0.0019	NA
Molybdenum	mg/l	0.1426	NA
Nickel	mg/l	0.1922	NA
Selenium	mg/l	0.0078	NA
Strontium	mg/l	0.9081	NA
Tin	mg/l	0.1941	NA
Vanadium	mg/l	0.4244	NA
Zinc	mg/l	1.3159	NA

TABLE 1 (cont.)
SURFACE WATER QUALITY

	UNITS	INFLUENT CONCENTRATION	EFFLUENT
<u>Dissolved Radionuclides</u>			
Gross Alpha	pCi/l	17.70	NA
Gross Beta	pCi/l	33.86	NA
Plutonium 239/240	pCi/l	0.17	NA
Total Uranium	pCi/l	10.17	NA
<u>Total Radionuclides</u>			
Gross Alpha	pCi/l	632	NA
Gross Beta	pCi/l	463	NA
Plutonium 239/240	pCi/l	7.34	NA
Americium 241	pCi/l	2.96	NA
Total Uranium	pCi/l	13.21	NA

The influent concentrations are based on flow-weighted maximum concentrations of 903 Pad and Lip Area Seeps (SW-50, -51, -52, -55, -57, -58, and -77), SW-53, -59, -63, -64 and Upper South Walnut Creek seeps and surface water stations (SW-56, -60, -61, -101).

The effluent concentration requirements are based upon Applicable or Relevant and Appropriate Requirements (ARARs). The "U" designation following the effluent concentrations indicates that the concentration is the detection limit for that constituent.

be conducted when the operation begins to determine the need for hearing protectors. Control of noise hazards shall be in accordance with 29 CFR 1910.95. Noise hazard areas (greater than 85 decibel average continuous, or 140 decibel impulse) must be appropriately marked and hearing protection for noise attenuation worn when in the area.

4. **Electrical Shock**
Electricity is provided for operations by EG&G. The filtration system will be properly grounded, with outlets protected with ground fault interrupters. All electrical cords will be rated for the task involved, and will be inspected prior to use to insure good working condition.
5. **Vehicles**
On site speed limits have been established at 5 mph. Site characteristics has developed numerous short visibility areas, blind spots and a need to reduce dust disturbance (IHSS/SWMU) which requires slow speeds. Seat belts will be worn by all workers in vehicles.
6. **Granular Activated Carbon (GAC)**
GAC preferentially removes oxygen from air. Warning signs will be provided to indicate the potential for a low-oxygen area. Warning signs will also be provided indicating that the access doors to the trailer remain open while servicing the GAC units.
7. **Heat - Ambient Air**
During summer months temperatures will range from 70°F to 95°F. Crews will maintain proper fluid intake, break in shady areas, and observe each other for signs of 'Heat Stress.'
8. **Cold -** During winter months temperatures could range from 40°F and below. Crews will watch each other for signs of cold stress. Warm fluids and frequent breaks may be deemed necessary.
9. **Rain -** Spring and Summer rains will make for slick surfaces and an increase in volumes of water to treat.
10. **Snow -** Winter snows will make for slick surfaces, reduced visibility and possible ground blizzard.
11. **Electric Storms -** During electric storms crews will remain indoors or in a vehicle until it passes. All equipment shall be properly secured and grounded.
12. **Lifting/Moving -** Proper techniques for lifting shall be used when changing filters. Mechanical devices shall be used whenever possible.
13. **Rough Terrain -** Rocky Flats Plant is located near the

foothills so terrain has hills, valleys, slopes, ditches etc. Crews shall pay attention while on foot or off road in a vehicle.

14. Structural Integrity -The trailer should be an enclosed, self contained unit, stable and will be anchored in accordance with Rocky Flats Low Importance Siesmic Criterion and for high wind stability.
15. Remote Area - Areas of Rocky Flats Plant are isolated and have poor visibility. Crews will have a portable phone or radio contact with one another and with RFP Emergency Response (966-2911).
16. Heavy Equipment - Some heavy equipment will be used to move the trailer and plow roads. All equipment shall have roll cages and seat belts. Back up alarms shall be on all pieces of equipment.
17. Materials Handling - All materials shall remain in original containers if possible. Proper storage and usage shall be followed.
18. Storage Flammable Gas/Liquid
Diesel fuel shall remain in proper D.O.T. approved container or in fuel tank on Riedel pickup or in properly grounded double wall storage tank. All other fuels will be stored in approved safety cans.
19. HazMat Use/Corrosives
Acids used to treat samples shall remain in original container and handled using safe work practices. Nitrile or Neoprene gloves will be worn when handling corrosives.
20. Hand Tools - Hand tools will be inspected weekly and before each use for wear, jagged edges, split or broken handles and removed from service if defects are found. All manufacturers procedures shall be followed.
21. Power Hand Tools - Power tools shall be inspected weekly and before each use. Any defects the tool is to be pulled from service and tagged for repairs. All manufacture's procedures shall be followed.
22. High Pressure Water - Water will be flowing thru pipe and hose. Connections and clamps are to be inspected daily. Spare fittings and hoses will be kept on site should there be a rupture. Additionally, the system will be equipped with pressure controls and relief (and backup pressure relief) to protect against overpressurization. All exterior piping in doubly contained; all interior piping is contained in a bermed area; the equalization tank is contained in a secondary tank. Should a problem arise, any spillage will be contained within the secondary piping, tank or within the containment berm; the

spillage will be directed to the tank for treatment for discharge.

23. Wind - Rocky Flats being along the front range catches numerous days of high winds. All equipment, trailers, and pumps shall be anchored as not to be effected by the wind. In excessive wind employees shall remain in an anchored trailer or vehicle. During construction, winds in excess of 15mph the job will shut down.
22. Confined Space Entry - Installation of the pipelines within the culvert under the buffer zone access road will require entry. All procedures will closely follow RES' and EG&G's confined space entry program (See Appendix B).
23. Lift Equipment - Installation of the System will require use of a small crane to off load and locate equipment.
24. Ladders - Ladders may be used periodically to inspect the tank and trailer. The ladder will be secured at top and bottom for slide out and safety harnesses will be worn when necessary.

5.2 ENGINEERING CONTROLS

The engineering controls built into the water treatment system to minimize risk of exposure include:

1. Closed system from weirs to discharge
2. Pressure relief valve to shunt excess water to storage tank at pressure in excess of 12 psig.
3. Air auto-release valve for each GAC unit.
4. Cleanup pump on floor under GAC units.
5. Heat, ventilation and air-conditioning unit in the trailer.
6. PVC piping to withstand pressure in excess of 100 psi.
7. Visual and audible alarm system for overflow or low volume.
8. Backflush and drain GAC units immediately with water prior to removal.
9. All water will be returned to the equalization tank for treatment for discharge.

A deluge shower will be built in the front of the trailer. Workers will be instructed to remove clothing immediately and flush any body part that comes in contact with the contaminated water.

The shower is a pressure vessel with built in eye wash and drench hose. It will contain solution and be pressurized to not over 90 PSI.

5.3 SAFE WORK PRACTICES

Safe work practices by workers to minimize risk of exposure to contaminants include:

1. Familiarity with hazards, symptoms of exposure and first aid for chemical contaminants present in filtration water, via on-site training.
2. Wear PPE of saranex suit, nitrile gloves and face splash protection when performing work expected to encounter contaminated water such as sampling, filter changes, system repair/maintenance.

Although contact with contaminated water is not anticipated, workers will be informed of the hazards of the contaminants in compliance with 29 CFR 1910.1200 and 1910.120. MSDS' will be kept on site as Appendix B to this site safety plan.

6.0 GENERAL TRAINING

All personnel who work on this site will complete 40 hours of classroom training in handling hazardous waste (O.S.H.A. 1910.120). This training includes:

- Regulatory Compliance (OSHA, EPA, DOT)
- Toxicology
- Flammables
- Corrosives and Reactives
- Respiratory Protection
- Protective Clothing
- Noise Stress
- Heat/Cold Stress
- Ionizing Radiation
- Drum Handling
- Confined Space
- Decontamination
- Environmental Monitoring
- Site Safety Plans
- Medical Surveillance
- Contingency Plans

The classroom training is followed by three days of on-the-job training, supervised by experienced personnel. Annually all field employees receive eight hours of refresher training on the above topics.

Managers and supervisors receive eight hours of training on safe management of hazardous sites. All training complies with 29 CFR 1910.120. All RES field employees receive initial and recertification training in First Aid and CPR. Site specific training for this project includes a 24 hour class put on by EG&G in Radiation Safety and operations.

6.1 TRAINING FOR SITE SPECIFIC HAZARDS

All employees who are subject to exposure to the organics, dissolved metals and total metals of the filtered water shall be informed of the following:

- . Specific nature of the operations which could result in exposure to contaminants.
- . The purpose, proper selection, fitting, use and limitations of protective equipment applicable to work with contaminated water.
- . A description of the medical surveillance program to evaluate for effects of exposure.
- . Information concerning the symptoms and adverse health effects associated with exposure to the contaminants.

- . Routes of exposure (skin penetration, inhalation, and ingestion).
- . First Aid for exposure to the contaminants.

6.2 TAILGATE SAFETY MEETINGS

Job site tailgate safety meetings shall be conducted by the health and safety officer or the shift foreman at the beginning of each shift for each job and whenever new employees arrive at the job site. The meetings discuss the Health and Safety considerations for that day's activities and outline the protective equipment necessary. Minutes of the meetings will be maintained. Weekly safety meetings will be conducted by the Project Manager with the aid of one crew member from each shift discussing a site specific topic of concern.

7.0 SITE CONTROL

Access to the site will be controlled by Riedel with assistance from the EG&G security staff. Only qualified individuals may enter the site and perform work on the project, and will require understanding of this Site Safety Plan (as indicated by signature on the safety plan). The site is visible from the inner east gate and proper signs will designate areas for safe entry.

Zones will be established as defined by the tasks and PPE requirements outlined in section 8.0 of this plan. The zones will include an exclusion zone, contamination reduction zone and support zone.

8.0 PERSONNEL PROTECTIVE EQUIPEMENT

At all times, all workers on site will wear steel-toe shoes and hard hats. When performing tasks presenting a risk for exposure to contaminants, workers will wear modified level "D" protection (SEE Table 2). This includes:

- Hard Hats
- Steel-Toe Shoes
- Shatter resistant eye goggles or face shield
- Nitrile Gloves
- Saranex Suit

No changes to the specified levels of protection shall be made without the approval of the site safety offices and/or the project manager.

Contaminated protective equipment shall not be removed from the regulated area until it has been decontaminated or properly secured for decontamination elsewhere.

Legible and understandable precautionary labels shall be affixed prominently to containers of contaminated scrap, debris, waste water and clothing prior to storage on site.

No food or beverage shall be present or consumed in the designated contaminated zones. Eating or drinking shall be allowed only in designated areas and only after hand and exposed skin has been washed.

No tobacco products shall be present or used in contaminated zones. Cosmetics shall not be applied in the contaminated zones.

All work on the project will be conducted according to the "Buddy" system.

TASK	HAZARD															
	MOD. LEVEL D REQ'D	Low Level RAD	IHSS/SWMU	Noise	Electrical Shock	Vehicles	GAC	Heat	Cold	Rain	Snow	Electric Storm	Lifting/Moving	Rough Terrain	Structural Integrity	Remote Area
WEIR INSTALLATION	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
PIPELINES	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
HEAT TRACE/INSUL.	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
TANK INSTALLATION	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
TRAILER SETUP	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
GEN SET INSTALL	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
TRAILER HOOKUP	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
WEIR INSULATION	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
FINAL WIRING	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
ACCEPTANCE TEST	*	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

TABLE 2

TASK/HAZARD RELATIONSHIP
WITH PPE REQUIREMENTS

9.0 MEDICAL RESPONSE

This is a statement of procedures to be followed in the event of a medical emergency at the site. The plan is divided into several separate procedures depending on the severity of the injury. It is the responsibility of the Project Manager to judge the severity of injuries and take appropriate action. Basic first aid will be administered by RES personnel as necessary until medical assistance is available. All RES personnel are trained in American Red Cross First Aid and CPR. A first aid kit will be kept in the office part of the trailer.

Non-emergency Accidents Requiring Medical Attention

Anyone involved in an accident resulting in injury requiring non-emergency medical assistance (i.e., minor cut, sprains, etc.) will be sent to:

Hospital Name: Arvada Emergency Clinic

Address: 5730 Ward Road, Arvada, Colorado

Phone: (303) 422-8090

Directions: From east gate at Rocky Flats, go right on Hwy 72 to stop sign, turn left to Indiana and proceed south to 64th Ave. Turn left, and go to Ward road. Turn right on Ward Rd. and go south to 57th Ave. Turn left into clinic.

9.1 RECORD KEEPING

The Health and Safety Liaison Officer or SHSC shall retain a copy of the completed Figure A-3 for each employee in the Confidential Employee Training and Medical Certification File at the ER remedial project work site.

The Occupational Safety Division will maintain the completed figure A-4 along with the exposure data gathered during area sampling and personnel monitoring.

These records must be accessible to the employee for review.

9.2 MEDICAL SURVEILLANCE

Pre-employment and periodic update medical examinations are required for persons working with, or those who may be assigned to work with hazardous waste. The medical examination must have been within a 12-month period prior to on-site activity and repeated annually. Physical examinations are conducted for RES workers by Tridem Medical Services in Denver, Colorado. A fitness for duty statement for each worker will be kept on site. A description of the RES Medical Monitoring Plan is on file in the RES office and on site in trailer.

10.0 DECONTAMINATION

Workers having contact with the contaminated water (via sampling or system maintenance or accidental exposure) will decontaminate themselves in the deluge shower at the trailer. Workers will wash their hands with water following each sampling. Following an accidental exposure to the skin, workers will flush their skin with water for fifteen minutes. Following an accidental exposure to the eyes, workers will flush their eyes for fifteen minutes with water.

All PPE shall be collected, segregated and properly disposed of. Disposal shall meet all Federal, State, and DOE policies.

Tools and equipment shall be properly "deconned" and inspected before removal from site.

11.0 COMMUNICATION

The small work area and close proximity of workers will allow face to face communication among workers. A phone will be located in the office part of the trailer for communication in emergencies.

If necessary, two way radios will be incorporated where employees are outside a line of site from each other.

All hazard areas will be properly identified and marked with signs advising of danger or exposure potential.

The on-site emergency phone number is 966-2911. This will activate the fire department and security to any situation.

All D.O.E. and Rocky Flats emergency procedures shall be followed.

<u>Alarm</u>	<u>Device/sound pattern</u>	<u>Action to be taken</u>
Evacuation	Boat Hailer/1 long blasts	Evacuate the controlled area or move to an area of safe refuge until evacuation can be completed
Take Cover	Boat Hailer/2 short blasts	Move to an area of safe refuge until "ALL CLEAR" is sounded

11.1 SITE SAFETY EQUIPMENT

FIRST AID KITS

<u>TYPE</u>	<u>LOCATION</u>
50 Item Standard	Trailer
10 Item Standard	Vehicles

Note: All first aid kits shall be approved in accordance with 29 CFR 1910.151.

FIRE EXTINGUISHERS

<u>TYPE</u>	<u>LOCATION</u>
10 # A, B, C	Trailer
2 1/2 # A, B, C	Vehicles

EYEWASH STATION/DELUGE SHOWER

<u>TYPE</u>	<u>LOCATION</u>
-------------	-----------------

15 Gallon Portable Eyewash/Shower

Trailer

PERSONAL PROTECTIVE EQUIPMENT

<u>TYPE</u>	<u>AMOUNT</u>
Saranex	1 CS
*PVC Boots	4 PR
Nitrile Gloves	2 DOZ
Duct Tape	4 ROLL
Splash Shield	2 EA
*Ear Plugs	50 PR
*Safety Glasses	6 PR

Note: These items (*) are issued to RES personnel; amounts indicated are in addition to these issued.

12.0 MONITORING

EG&G will provide badges for all RES personnel. RES employees will authorize results of the badges to be released to EG&G and RES. During the construction phase a daily sweep of the area will be conducted by EG&G. An air monitoring station will also be near the area (operated by EG&G) to check for airborne contamination.

Ultimately RES personnel will begin to do their own monitoring upon completion of EG&G Rad safety and operation classes.

RES will make regular observations of the wind direction using such visual indicators as wind flag. To avoid inadvertent exposure to harmful dusts, employees will be warned to remain upwind of all work areas whenever possible. Work will shut down if wind speeds exceed 15 mph.

When working in or around confined spaces continuous monitoring with LEL, and O₂ meters shall be used as generally required by RES Class A & B confined space entry. In addition a Rad sweep shall also be conducted to assure worker safety. Copies of RES confined space procedures are in the Appendix A of this plan.

During GAC unit service, RES will leave access doors to the trailer to allow adequate ventilation.

[illegible]

I CERTIFY THAT I HAVE READ AND UNDERSTAND THIS HEALTH AND SAFETY PLAN FOR THE INSTALLATION OF THE OU2 GAC TREATMENT SYSTEM:

PRINT NAME

SIGNATURE

COMPANY

DATE _____

[illegible]

[illegible]

APPENDIX A

HSP FIELD CHANGE FORM

HSP FIELD CHANGE

Field Change Number: _____

Date Effective: _____

- Pen and Ink changes to be made in the HSP to alert the reader of this change:

- Reason for the change to be incorporated into the HSP:

- Text of Change to be incorporated:

HSP FIELD CHANGE

Field Change Number: _____

Date Effective: _____

Review and Approval Signatures:

ER Health and Safety Officer

/ _____
Date

ER Program Manager

/ _____
Date

Director - Environmental Restoration

/ _____
Date

Health and Safety Liaison Officer

/ _____
Date

Occupational Safety Manager

/ _____
Date

Director - Health and Safety

/ _____
Date

ROCKY FLATS PLANT
Environmental Restoration
Health and Safety Program Plan

APPENDIX B

RES CONFINED SPACE ENTRY PROCEDURE

(REVISION 5)

RIEDEL ENVIRONMENTAL TECHNOLOGIES, INC.
CONFINED SPACE ENTRY PROCEDURES
2/8/91
(Rev.5)

This procedure will be followed by all RES personnel entering a confined space for any work task. Strict adherence with this procedure is necessary to prevent serious injury or death. Failure to follow this procedure will be considered a serious violation of RES safety policy and will result in disciplinary action.

This procedure is based on guidelines contained in the NIOSH criteria document "Working in Confined Spaces" published December 1979 and meets or exceeds current Federal and State safety regulations.

All personnel entering a space must be thoroughly trained in this procedure. Special emphasis must be placed on ensuring that personnel can perform rescue operations efficiently.

I. RET POLICY

- A. No person, under any circumstances, will enter a space containing an explosive or oxygen enriched atmosphere; or one which has been deliberately inerted (oxygen deficient) for the purpose of making it safe for hot work.
- B. Decisions to enter a space deemed IDLH (referring to a toxic gas or vapor) will be made in conjunction with the Regional Safety Manager/Safety professional. As a general rule, policy will be to avoid entry in these conditions. When required, any entry to IDLH, or possible IDLH, will also wear Level B. Note that an IDLH atmosphere does not necessarily offer the same immediate hazard as oxygen deficient or explosive atmospheres.
- C. Any person or persons entering a space of unknown hazard will wear a supplied air respirator and retrieval equipment and will be backed up by a rescue person dressed to a similar level of protection.
- D. All entries into spaces with unknown hazards will be supervised by a RES manager completely familiar with this procedure. This manager will be responsible for enforcing all the provisions contained in this procedure.
- E. No matches, lighters, or any other items capable of producing a spark or flame are allowed in a confined space. Non approved radios, flashlights, or lanterns shall not be used in or within 25 feet of a confined space containing/potentially containing flammable vapors or gases.
- F. All procedures will be discussed with all involved personnel prior to the entry.
- G. Any deviations from this procedure will require the approval of the Regional Safety Manager.

II. DEFINITIONS

- A. Atmosphere:

Generic term for gases, vapors, mists, fumes, and dusts within a confined space.

B. Atmosphere Testing/Air Monitoring

The use of a combustible gas/oxygen meter, and/or a gas specific instrument to monitor the atmosphere inside a confined space. This definition includes the previous RET policy on instruments that:

1. All instruments are to be calibrated or span checked prior to use.
2. Any monitoring will be performed by personnel familiar with equipment operation.
3. Daily span check records will be maintained in the permanent job file.

C. Confined Space

A confined space is one with one or more of the following traits: limited openings for entry and exit; limited natural ventilation; toxic or oxygen deficient atmospheres; and/or areas that are not designed for continuous occupancy. Examples are: storage tanks, underground sumps, pipelines, pits, trenches, tunnels, ship holds, etc.

D. Confined Space Class A

A confined space that presents extreme immediate hazard conditions to occupants. These would include any one or more of the following: oxygen deficiency; potentially flammable or explosive atmospheres; or toxic IDLH atmospheres. Specific parameters include:

- | | | |
|----|------------------------|---|
| 1. | Oxygen: | Less than 19.5% |
| 2. | Lower Explosive Limit: | Greater than 10% |
| 3. | Toxic Atmosphere: | Greater than IDLH (or possible to exceed) |

Personnel will wear Level B protection during entry.

E. Confined Space Class B

A space that has potential for developing adverse health and safety conditions for personnel if preventative measures are not taken. Specific measurement parameters:

- | | | |
|----|---------|--|
| 1. | Oxygen: | 19.5% - 24.9% |
| 2. | LEL: | Less than 10% |
| 3. | Toxic: | Greater than PEL but less than IDLH and Respirator MAC |

Personnel will wear Level c protection during entry.

F. Confined Space Class C

A confined space that has limited hazards such that special modifications are not needed for work procedures. Specific measurement parameters:

- | | | |
|----|---------|---------------|
| 1. | Oxygen: | 19.5 to 24.9% |
| 2. | LEL: | Less than 10% |
| 3. | Toxic: | Less than PEL |

Personnel can wear Level D protection during entry.

G. Confined Space Entry Permit

1. A RES form (RET-041) which needs to be filled out prior to any confined space entry. Complete use of the form will insure that all health and safety considerations have been addressed prior to entry. This form is signed by all personnel and acts as a permit for the entry. This form is used in conjunction with this procedure to determine special precautions necessary for entry.
2. The second side of the form contains a section for recording air monitoring and equipment calibration data.
3. The permit becomes a permanent part of the job file. An example form is attached.

H. Fall Protection

Equipment and procedures utilized to prevent falls while entering and exiting a confined space. A specific RES procedure titled "Fall Protection Procedures, March 1989, (Rev.2) is to be followed when fall potentials or difficult retrieval conditions exist.

I. Hot Work

Any work being performed that presents an ignition or heat source. Examples are: welding, grinding, burning, chop saw abrasive disk usage, or chipping.

J. Inerting

1. The process of purging the atmosphere of a space with an inert gas (one which will not support combustion) to eliminate the potential for fire or explosion. The typical gas used will be either carbon dioxide or nitrogen. Inerting does not remove the source of flammable vapor (i.e. flammable liquids) but instead removes the oxygen/flammable vapor above the liquid.
2. A RES procedure titled "Tank Inerting Demolition/Repair Procedure" (Rev.2) is to be used when inerting procedures are needed.
3. Personnel are not to enter tanks that have been inerted until the space has been purged with fresh air.

K. Intrinsically Safe/Explosion Proof

1. Electrical equipment which does not present the potential for electrical spark and/or which is designed and constructed to contain any fire or explosion inside the unit preventing propagation of fire back into the general environment. This equipment has been certified as safe for use in flammable atmospheres.
2. All electrical equipment taken into a space containing (or previously containing) flammable liquids or vapors will be rated Class I Group C & D at a minimum, and Class II, Group G at a minimum.

L. Isolation

The act of ensuring that the space cannot be accidentally refilled with product with produce and/or re-energized electrically or mechanically while personnel are inside.

M. Lockout

1. The act of physically locking out electrical, hydraulic, or pneumatic controls and/or mechanical linkage to ensure isolation. Typically performed by lock and key or the physical removal of key components that make it impossible for a system to be restarted while personnel are working on or inside the system.
2. A RES procedure titled "Electrical and Mechanical Lockout" is to be used when lockout is needed.

N. Mechanical Ventilation

1. A method of providing ventilation into a confined space. Typically provided by electrically powered or air driven blowers. From a ventilation engineering standpoint, air blown into a space is the most effective in ensuring consistent dilution inside the space.
2. Negative pressure can be provided by placing the blower inside the space. This method can be effective in ensuring that clean air is drawn into the space, but is not as effective in producing uniform dilution of contaminants.
3. Use of continuous mechanical ventilation will be necessary when working inside Class A or B spaces. Ventilation must be provided at the minimum rate of four (4) air changes per hour.
4. Flexible tubing or duct work is used to distribute air to all areas of the space. Ventilation equipment must be bonded and grounded.
5. Considerations must be made for dealing with flammable vapors displaced from a space. Exhausted gas may have to be ducted to a safe location.

O. Natural (Gravity) Ventilation

Ventilation provided to a space by non-mechanical means. Air moving into a space opening would be considered natural ventilation. This is not an effective method for ensuring the safety of personnel and/or reducing the flammability potential inside the confined space.

P. Oxygen Deficiency

An atmosphere where oxygen concentration is less than 19.5% by volume. State and Federal safety regulations require that personnel wear air supplied respirators in oxygen deficient atmospheres.

Q. Oxygen Enriched

An atmosphere where oxygen concentration is greater than 25% by volume. Fire and explosion potentials are increased greatly.

R. Purging

The displacement of the atmosphere inside a space with fresh air or an inerting gas.

S. Emergency Retrieval Equipment

1. Mechanical hoist equipment designed to raise and lower personnel from a space. This equipment is attached to a tripod or other supporting structure which are capable of being a support platform for other fall protection equipment. All equipment used for raising or lowering personnel will be rated for such operations by the manufacturer.
2. Use of this equipment is described in the RES procedure "Fall Protection Procedures".

T. Rescue Person

A person dressed to the same level of protection as the entry person. This individual's sole function is rescue. A rescue person will be required for all Class A and B space entries.

U. Support Person

A person who will be stationed outside a confined space while workers are inside. This person is trained in confined space procedures. This person does not have other duties that will take him away from the confined space while workers are inside.

V. Saddle Vent

A piece of equipment that allows a ventilation duct to be placed in a manhole and still allow personnel to enter/exit without the duct being removed. This allows continuous ventilation inside the space.

W. Unknown Hazard

A space where the hazard potential is unknown. Air monitoring from outside the space is unable to determine if all areas inside are free of hazard. In these cases, personnel will consider the space Class A.

X. Zero Mechanical State (ZMS)

The point where all power sources, that can produce a machine member movement, have been neutralized. This includes all pneumatic, electrical, and mechanical components.

III. POTENTIAL HAZARDS

The following represent the general hazards that can be expected in the variety of confined space jobs RET personnel have or will be exposed to. Each hazard must be assumed until proved otherwise:

- A. Insufficient or Enriched Oxygen
- B. Toxic dusts, mists, fumes, smoke, vapor and gas.
- C. Flammable and explosive gases, liquids, vapors, and dusts
- D. Inadequate access opening for entry/egress
- E. Start up of agitators, tumblers, crushers, mixing blades, screw conveyors, saws, etc.

S. **Emergency Retrieval Equipment**

1. Mechanical hoist equipment designed to raise and lower personnel from a space. This equipment is attached to a tripod or other supporting structure which are capable of being a support platform for other fall protection equipment. All equipment used for raising or lowering personnel will be rated for such operations by the manufacturer.
2. Use of this equipment is described in the RES procedure "Fall Protection Procedures".

T. **Rescue Person**

A person dressed to the same level of protection as the entry person. This individual's sole function is rescue. A rescue person will be required for all Class A and B space entries.

U. **Support Person**

A person who will be stationed outside a confined space while workers are inside. This person is trained in confined space procedures. This person does not have other duties that will take him away from the confined space while workers are inside.

V. **Saddle Vent**

A piece of equipment that allows a ventilation duct to be placed in a manhole and still allow personnel to enter/exit without the duct being removed. This allows continuous ventilation inside the space.

W. **Unknown Hazard**

A space where the hazard potential is unknown. Air monitoring from outside the space is unable to determine if all areas inside are free of hazard. In these cases, personnel will consider the space Class A.

X. **Zero Mechanical State (ZMS)**

The point where all power sources, that can produce a machine member movement, have been neutralized. This includes all pneumatic, electrical, and mechanical components.

III. **POTENTIAL HAZARDS**

The following represent the general hazards that can be expected in the variety of confined space jobs RET personnel have or will be exposed to. Each hazard must be assumed until proved otherwise:

- A. Insufficient or Enriched Oxygen
- B. Toxic dusts, mists, fumes, smoke, vapor and gas.
- C. Flammable and explosive gases, liquids, vapors, and dusts
- D. Inadequate access opening for entry/egress
- E. Start up of agitators, tumblers, crushers, mixing blades, screw conveyors, saws, etc.

- F. Avalanche of materials or falling objects
- G. Opening of feed lines which introduce corrosives, heated or gaseous substances such as steam, water, blast furnace gas, or other substances hazardous to health.
- H. Electrical shock or electrocution from plug-in lights, tools, or other portable equipment.
- I. Temperature extremes
- J. Pressurized lines containing hydraulic oil, gas, or other fluids.
- K. Inadequate illumination
- L. Distance of work area from exit and obstacles in between.

IV. PRE-ENTRY PROCEDURES SUMMARY

A. Confined Space Classification

Specific requirements for entry into confined spaces will be based on the space classification. These requirements are summarized on a one page summary form. An "X" next to each sub item means that specific item is a requirement. An "O" next to the item means that it is an option based on the specifics of that entry. The RES Regional Safety Manager has the responsibility for determining what optional items will be required on the project.

B. Confined Space Entry Permit System

An Entry Permit shall be completed prior to entry into any confined space. This permit shall be available at the work site location of the confined space and shall be dated and valid for one shift only.

1. The RES entry permit (RET-041) is required for all entries.
2. All questions on the form must be filled out. Pay close attention to identifying the correct classification of the space.
3. When answering the questions on side 1 of the permit, the goal is to have a "yes" answer to each question. In some cases, a "n/a" is appropriate and would indicate that the specific item does not apply to the situation. Use caution when deciding that the item is "n/a".
4. Special attention must be directed to any question where the answer is "no". A "no" answer may indicate that adequate precautions have not been taken or that a hazard possibly continues to exist. Entry will not be made until all "no" conditions have been corrected.
5. The Entry permit cannot be completed until all testing and sampling has been accomplished. This means that it must be filled out at the site under actual working conditions.

6. The project Safety Officer, as named on the entry permit, shall evaluate, plan, and implement the procedures necessary to safeguard the personnel assigned to the job. He/she has responsibility to evaluate/approve any "n.a" or "no" answers on the permit.

C. **Work Space History**

Efforts should be made to determine the present and previous products contained in the confined space. This information should be listed on the permit form.

D. **Initial Atmosphere Testing**

1. Prior to entry, all spaces will be initially tested for flammable vapors and oxygen deficiency, plus toxic vapor or gases (based on the potential for toxics being present).
2. The person assigned the task of monitoring shall know the proper procedure for calibration and operation of all sampling equipment.
3. CGIs will be span checked prior to entry to ensure proper operation and will be calibrated if needed. CGIs will not be used for certifying an area "safe for entry" if a span check has not been made.
4. Oxygen meters used to confirm the completeness of inerting will be tested with a 100% inert gas atmosphere to ensure that the meter will read 0% oxygen.
5. When monitoring, measurements will be made from top to bottom and in all remote sections of the space. It may be necessary to enter the space to test remote locations. In these situations, personnel will be dressed in Level B PPE and will have rescue personnel available who are also dressed to the same level of PPE.

E. **Isolation/Lockout/Zero Mechanical State**

Before entering any confined space personnel will take sufficient steps to ensure that it is impossible for toxic contaminants, or potentially hazardous products to reenter a space or hazardous situations to develop while personnel are inside.

1. **Electrical Isolation/Lockout**

- a. Shall be achieved by locking circuit breakers and/or disconnecting the ON position level with a key type padlock.
- b. Ideally the key is to remain with the person working inside the confined space. If more than one person is inside the confined space, each person shall place his/her own lock on the electrical disconnect. In some cases it may be more feasible for one supervisor to have the lock for an entire trade group with the understanding that this supervisor is responsible for insuring all individuals have safely accounted for before removing the lock.

2. **Mechanical/Pneumatic Isolation**

- a. Isolation of all moving parts shall be achieved by disconnecting or capping any linkage, valves, drive belts, shafts, water/steam lines, chaining controls, or systems which enter, feed, or impact in the confined space.
- b. Equipment with moving mechanical parts shall be blocked so that there can be no accidental movement.
- c. Pneumatic and hydraulic lines will be bled to remove any remaining pressure to remove possibility of equipment movement.

3. **General Guidelines**

- a. Make certain that you can't accidentally re-energize a system, ie that there are not any additional run buttons that you might have missed.
 - b. Try all operator switches in all control positions.
 - c. Before using voltage tester on unknown system, try it on a known energy source.
 - d. Check circuits on the load side after they have been disconnected.
 - e. After performing voltage check, recheck tester on a known source.
 - f. Discharge any electrical or mechanical component that can contain potential energy.
4. While performing work on at non RET location, it is not always possible to have total control over a client's property. When there is question about the adequacy of isolation, RET job managers are required to contact the RES/RET Safety Coordinator/Manager to ensure that adequate steps are being taken.

F. **Purging and Ventilation**

1. Prior to entry, mechanical ventilation will be initiated for Class A and B spaces to reduce, or maintain flammable vapor levels to 10% LEL or less.
2. Ventilation will be continuous in Class A/B spaces. Note that ventilation is not always sufficient to ensure that toxic environments are rendered safe (below PEL or IDLH concentrations).
3. Note that this ventilation will discharge contaminants outside the space and will therefore present exposure potentials to outside personnel. This discharge may also present fire or explosion hazards outside the space.
4. Electrical fans will not be placed inside a space that contains flammable vapors.
5. When entering manholes or other small openings, a saddle vent will be utilized if the duct work will interfere with entry/egress. An alternative is to use flexible poly tubing which can be easily compressed which will allow passage

to full face respirator (category 1, 2, or 3) or full face protective hood for category C if eye/skin irritating mists, chemicals, vapors, or dusts are present.

- b. All respirators shall be NIOSH/MSHA approved devices and shall be fitted and maintained in accordance with the RET Respiratory Protection policy.
- c. All persons wearing respirators in a confined space and rescue personnel shall have attended a respiratory training program on the specific respiratory equipment they are wearing.

5. Body Protection:

All workers entering a confined space shall wear full coverage work clothes sufficient to protect the wearer against known or suspected toxic or irritating materials. Specific type of suit material will be described in the permit.

6. Hearing Protection

Many times, reverberation or ventilation systems result in increased noise levels in confined spaces. Hearing protection shall be used when noise levels and exposure times exceed those in 29 CFR 1910.95 or State standards.

7. All workers shall wear a hard hat.

6. Ventilator air intakes shall be located so they will not pickup exhaust gases from vehicles, heaters, furnaces, or adjacent operations capable of generating airborne contaminants.
7. Duct work should be placed so that there are unnecessary bends are eliminated. One 90 degree bend can reduce the output to 70% of rated capacity; two 90 degree bends to 50%, three bends to 33%, etc.

G. Safety Equipment

The following equipment requirements are to be considered minimum and must be provided prior to start up and initial entry of the individual.

1. Oxygen and Combustible Gas Indicators, calibration kit, and response chart appropriate to test for and interpret the flammable atmosphere.
2. Photo Ionizing Detector, Detector tubes as appropriate to determine toxic content of atmosphere.
3. Mechanical ventilation equipment, ie blowers, compressor, hoses, and auxiliary equipment as designated for the confined space.
4. Respiratory/Face protection
 - a. The exact level and type shall be determined by the regional health and safety officer based upon the conditions and test results of the confined space and the work activity performed. Full face protection, ie full-face respirator (category A/B) or full-face plexiglass shield for category C if eye/skin irritating mists, chemicals, vapors, or dusts are present.
 - b. All respirators shall be NIOSH/MSHA approved devices and shall be fitted and maintained in accordance with the RET Respiratory Protection policy.
 - c. All persons wearing respirators in a confined space and rescue personnel shall have attended a respiratory training program on the specific respiratory equipment they are wearing.
5. Body Protection:

All workers entering a confined space shall wear full coverage work clothes sufficient to protect the wearer against known or suspected toxic or irritating materials. Specific type of suit material will be described in the permit.
6. Hearing Protection

Many times, reverberation or ventilation systems result in increased noise levels in confined spaces. Hearing protection shall be used when noise levels and exposure times exceed those in 29 CFR 1910.95 or State standards.
7. All workers shall wear a hard hat.

8.

Rescue Equipment

The specific type and degree of rescue equipment will depend upon the nature of the confined space with regard to access/egress. This decision would take into account the exact manner in which the individual could be feasibly extracted ie by the wrists, waist, straight up and the accompanying strain to the persons body.

- a. A body harness/belt is required when an employee is working in an area that, for purposes of rescue, is considered restricted and when any failure of ventilation could allow the build-up of toxic or explosive gases within the time necessary to vacate the area.
- b. A body harness is required for any vertical entry. A belt will usually be satisfactory for horizontal entry.
- c. If the worker in the confined space is required to wear a harness, the rescue/stand-by person shall also have a safety harness and air supplied respirator immediately available.
- d. Additional rescue equipment such as tripod, block and tackle, lifelines shall be available, set-up, and in working order if needed to remove a worker from a confined space. This equipment must be capable of being hand operated.

1. Training

1

Every person who may work in confined spaces or be tasked with providing support for confined space jobs shall have training in the hazards and correct procedures before initial entry into confined space.

2

Training shall consist of the following topics:

- a. Respirator training
- b. Confined space hazard recognition
- c. Use of ventilation equipment
- d. atmospheric sampling and testing devices
- e. use of all rescue and support equipment
- f. Emergency rescue procedures-practice
- g. lock out, tag-out procedures
- h. required personal protective equipment
- i. communication system
- j. CPR/First Aid
- k. explanation of the RET Confined Space Procedure
- l. explanation of contingency plan

V. ENTRY PROCEDURES OVERVIEW

Entry into a confined space shall be made only when a minimum of 1 person is available outside to handle communication, support equipment and to provide assistance or emergency aid as necessary.

A. Support person

1. All space entries require a standby person assigned to the project. This person's duties include maintaining communication and providing necessary assistance to workers inside.
2. This individual's primary responsibilities with Class A and B spaces are the initiation of rescue procedures (although this person will never go inside the space).
3. Support persons cannot leave a Class A or B space for any reason.
4. Class A and B spaces require that at least two other personnel are in the immediate area and can be summoned without the standby person having to leave the area.
5. Class C spaces only require that the person keep a general watch on those inside. Communication is either direct verbal or indirect/direct visual.

B. Rescue Person

1. Class A Spaces

Require that the rescue person be dressed to the same level of protection as the workers he is assigned to. He must be on station at the opening to the space in direct line of sight with those inside. This person will be on station the entire time that operations are being conducted.

2. Class B Spaces

Rescue person not needed.

3. Class C Spaces:

Rescue person not needed.

C. Continuous Atmosphere Monitoring

1. It is recognized that the condition in some spaces may change over time. Initial testing may underestimate hazards in these situations.
2. Continuous monitoring of flammable, oxygen, and/or toxics will be necessary where conditions could possibly change over a short period of time. Examples are: welding or cutting inside a tank, some cleaning operations, accidental release of product into the space, etc.
3. Once ventilation is started, periodic checks should be made of the surrounding area to insure that contaminated air is exhausted in a location that creates no hazard to people or equipment.

4. Remove personnel from the area if monitoring demonstrates that ventilation is not sufficient to maintain the atmosphere below 10% LEL.

D. Continuous Ventilation

1. Shall be maintained in Class A/B spaces. Not needed in Class C if there is no possibility of contaminant generation while personnel are inside.
2. Local exhaust ventilation shall be provided when mechanical ventilation is not capable of preventing a point source contaminant from producing unacceptable high concentrations in the ambient atmosphere. Example: spreading a flammable solvent on a surface inside a tank.

E. Lighting

1. All portable lights shall be intrinsically safe/explosion proof when working in potentially flammable atmospheres.
2. Heavy duty flexible cords will be used with good insulation and connectors. No splices are permitted. Cracked or worn insulation shall be replaced.
3. Lighting shall not be suspended by cords unless specifically designed for it.
4. All lights and plug assemblies should be checked with a volt/ground meter prior to use in confined space.

**RIEDEL ENVIRONMENTAL SERVICES, INC.
CHECK LIST OF CONSIDERATIONS FOR ENTRY,
WORKING IN AND EXITING CONFINED SPACES**

<u>ITEM</u>	<u>CLASS A</u>	<u>CLASS B</u>	<u>CLASS C</u>
1. RES Confined Area Entry Permit	x	x	x
2. Initial Atmospheric Testing for Combustibles & Oxygen	x	x	x
3. Continuous Air Monitoring	x	x	0
4. Pre-entry Briefing of Personnel	x	x	x
5. Pre-entry Space Preparation			
Isolate/lockout/electrical & mechanical	x	x	x
Purge and continuous ventilation	x	x	0
Requirements for special equipment/tools	x	x	0
6. Entry procedures			
Initial written plan with job objectives	x	x	x
Support person on station	x	x	x
Rescue person station (dressed to respond)	x	0	0
7. Safety Equipment and clothing			
Head protection	x	x	x
Hearing protection (>85dBA)	x	x	x
Hand protection (depending on contaminant)	x	x	x
Foot protection (depending on contaminant)	x	x	x
Body protection (depending on contaminant)	x	x	x
Respiratory protection	x	x	0
Safety belts with life lines	x	x	0
Life lines, harness, retrieval pulley (vertical entry)	x	x	x
8. Rescue procedures developed	x	x	x
9. Record keeping (equipment calibration, permits)	x	x	x

x = indicates requirement

0 = indicated determination by RES Safety Professional

	INSTRUMENT USED	LEL SPAN CONC.	LEL ACTUAL	H2S SPAN CONC.	H2S ACTUAL	CO SPAN CONC.	CO ACTUAL	OXY SPAN CONC.	OXY ACTUAL

AIR MONITORING DATA

TIME	INSTRUMENT USED	CONTAMINANT (LEL, O2, ETC.)	MEASURED LEVEL

TIME	INSTRUMENT USED	CONTAMINANT (LEL, O2, ETC.)	MEASURED LEVEL

PROJECT EQUIPMENT REQUIREMENTS

Personnel Protective Equipment

_____ Outer Suit Type _____
 _____ Chemical Boots
 _____ Outer Gloves Type _____
 _____ Hard Hat
 _____ Eye Protection Type _____

Respirators

_____ SCBA
 _____ Supplied Air with 5-minute Egress
 _____ Grade D Air Cylinders
 _____ Compressor with Purification Panel
 _____ APR Cartridge Type _____

ENTRY CHECKLIST	Page	of	Pages
<p>JOB NUMBER: _____</p>			
<p>DATE ENTERED: _____</p>			
<p>CLASSIFICATION OF CONFINED SPACE:</p> <p>) CLASS C: >19.5% O₂, <10% LEL, <TLV</p> <p>) CLASS B: >19.5% O₂, <10% LEL, >TLV, <IDLH, <MAC</p> <p>) CLASS A: <19.5% O₂, >10% LEL, >IDLH, >MAC</p>			
<p>CHEMICAL CONTAMINANTS: _____</p>			
<p>DESCRIPTION OF WORK: _____</p>			
<p>NUMBER OF PEOPLE REQUIRED ON PROJECT: _____</p>			
<p>DATE ISSUED: _____ VALID UNTIL: _____</p>			
<p>THIS PERMIT IS VOID AT THE END OF THE WORK SHIFT ON WHICH IS IT ISSUED.</p>			
Are hazards, testing and emergency procedures explained to all members of crew?	YES	NO	N/A
Are chemical and gas delivery lines disconnected and/or capped?			
Are electrical, mechanical, pneumatic power sources have been reduced to zero energy state (ZES)?			
Are controls to all power sources are locked and tagged out?			
Is monitoring equipment has been calibrated/span checked?			
Are combustible gas vapors are less than 10% LEL?			
Is oxygen concentration is greater than 19.5%			
Are toxic gas/vapor concentrations are less than IDLH?			

APPENDIX C

MSDS SHEETS

991001700



UNION CARBIDE CORPORATION
CARBON PRODUCTS DIVISION

MATERIAL SAFETY DATA SHEET

(Essentially similar to Form OSHA-20)

SECTION I	
Manufacturer's Name UNION CARBIDE CORPORATION, Carbon Products Div.	Emergency Telephone No. (304) 744-3487 (Day or Night)
Address (Number, Street, City, State, and ZIP Code) 270 Park Avenue, New York, New York 10017	
Product: ACTIVATED CARBON	Trade Name and Synonyms "Columbia" - All Grades

SECTION II - HAZARDOUS INGREDIENTS					
MATERIAL	%	TLV *	MATERIAL	%	TLV *
None as defined by United					
States Department of Labor					
29 CFR 1915, 1916, 1917					

* Current American Conference of Governmental Industrial Hygienist Limits.

SECTION III - PHYSICAL DATA			
BOILING POINT (°F.)	N/A	SPECIFIC GRAVITY (H ₂ O=1)	0.9
VAPOR PRESSURE (mm Hg.)	N/A	PERCENT VOLATILE BY VOLUME (%)	N/A
VAPOR DENSITY (AIR=1)	N/A	EVAPORATION RATE (_____ =1)	N/A
SOLUBILITY IN WATER	None		
APPEARANCE AND ODOR	Black odorless granules		

SECTION IV - FIRE AND EXPLOSION HAZARD DATA			
FLASH POINT (Method used)	N/A	FLAMMABLE LIMITS % by Volume	Le1 = N/A Uel = N/A
EXTINGUISHING MEDIA	Water, foam, CO ₂ , dry chemicals		
SPECIAL FIRE FIGHTING PROCEDURES	N/A		
UNUSUAL FIRE AND EXPLOSION HAZARDS			
Fire and explosive hazard of adsorbed materials must be identified and adequate protective measures taken.			

Continued on reverse side

SECTION V - HEALTH HAZARD DATA

THRESHOLD LIMIT VALUE	10 mg/m ³ (ACGIH limit for nuisance dusts)
EFFECTS OF OVEREXPOSURE	Inhalation of activated carbon dust may cause temporary respiratory irritation and discomfort. Potential hazard of adsorbed materials on used activated carbon should be identified.
EMERGENCY AND FIRST AID PROCEDURES	
	N/A

SECTION VI - REACTIVITY DATA

STABILITY	UNSTABLE		CONDITIONS TO AVOID	N/A
	STABLE	X		
INCOMPATIBILITY (Materials to avoid)	N/A			
HAZARDOUS DECOMPOSITION PRODUCTS	N/A			
HAZARDOUS POLYMERIZATION	MAY OCCUR		CONDITIONS TO AVOID	N/A
	WILL NOT OCCUR	X		

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED	
Follow good housekeeping practices.	
WASTE DISPOSAL METHOD	Dispose of in approved landfill, recognizing the potentially hazardous nature of adsorbed materials.

SECTION VIII - SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (Specify type) For above TLV dust concentration, wear NIOSH-approved respirator.			
VENTILATION	LOCAL EXHAUST	N/A	Special N/A
	MECHANICAL (General)	Maintain dust level below TLV	Other None
PROTECTIVE GLOVES	Recommended	EYE PROTECTION	Safety glasses or goggles.
OTHER PROTECTIVE EQUIPMENT	N/A		

SECTION IX - SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING	Do not enter vessel containing activated carbon without adequate breathing air supply.
OTHER PRECAUTIONS	Closed vessels may be low in oxygen level due to adsorbing characteristics of activated carbon. New activated carbon - store in closed containers indefinitely. Outside storage keep on pallets and under tarpaulins to keep container dry. Do not breathe dust.

OILS, FUEL: 1-D			OOD
Common Synonyms Diesel oil (light)	Oily liquid Floats on water.	Yellow-brown	Lube or fuel oil odor

Stop discharge if possible.
 Call fire department.
 Avoid contact with liquid.
 Isolate and remove discharged material.
 Notify local health and pollution control agencies.

Fire	Combustible. Extinguish with dry chemical foam or carbon dioxide. Water may be ineffective on small fires. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. LIQUID Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.
Water Pollution	Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify owners of nearby water intakes.

MATERIAL SAFETY DATA SHEET

Distributor:

General Air Service & Supply
1105 Iona Street
Denver, Colorado 80204
(303) 892-7003

Manufacturer:

Liquid Air Corporation
One Embarcadero Center
San Francisco, CA 94111
(415) 765-4500

Product Supplied: Reconstituted Breathing Air
Sold To: RIEDEL ENVIRONMENTAL SERVICES
5850 EAST 58TH AVE, SUITE F
COMMERCE CITY, CO 80022

SECTION I

PRODUCT NAME: Reconstituted Breathing Air
SYNONYMS: CGA Grade E Breathing Air
FORMULA: O₂-N₂
CHEMICAL FAMILY: Gas
ISSUE DATE: 2/19/85
DOT HAZARD CLASS: Nonflammable Gas
DOT ID NUMBER: UN1002

SECTION II - HAZARDOUS INGREDIENTS

None

SECTION III - PHYSICAL DATA

BOILING POINT: -300 F
LIQUID DENSITY AT BOILING POINT: N/A
VAPOR PRESSURE: N/A
GAS DENSITY: 0.28
SOLUBILITY IN WATER: Slight
SPECIFIC GRAVITY: 1.00
APPEARANCE AND ODOR: Colorless and Odorless Gas

SECTION IV - FIRE & EXPLOSION HAZARD DATA

FLASH POINT (Method Used): None - Nonflammable
FLAMMABLE LIMITS: LEL 0% UEL 0%
EXTINGUISHING MEDIA: None
SPECIAL FIRE FIGHTING PROCEDURES: Remove from direct heat or open flame, or keep cool with water fog

SECTION V - HEALTH HAZARD DATA

None

SECTION VI - REACTIVITY DATA

STABILITY: Stable

CONDITIONS TO AVOID: None

HAZARDOUS POLYMERIZATION: Will not occur

SECTION VII - SPILL OR LEAK PROCEDURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Leaks will dissipate rapidly and harmlessly to atmosphere

WASTE DISPOSAL METHOD: Vent to atmosphere in open area. Remove valves

SECTION VIII - SPECIAL PROTECTION INFORMATION

None

STORAGE RECOMMENDATIONS: Do not drop cylinders. Keep valve protection caps in place except when using. Store away from direct heat or open flame. Refer to CGA-P1, "Safe Handling of Compressed Gases", or OSHA 1910 Subpart H.

SECTION IX - SPECIAL PRECAUTIONS

May be used to comply with
OSHA's Hazard Communication Standard,
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (As Used on Label and List)

ALCONOX

Note: Blank spaces are not permitted. If any item is not applicable, or no
information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name

ALCONOX, INC.

Emergency Telephone Number

(212) 473-1300

Address (Number, Street, City, State, and ZIP Code)

215 PARK AVENUE SOUTH

Telephone Number for Information

(212) 473-1300

NEW YORK, N.Y. 10003

Date Prepared

JULY 1, 1987

Signature of Preparer (optional)

Section II — Hazardous Ingredients/Identify Information

Hazardous Components (Specific Chemical Identity; Common Name(s))

OSHA PEL

ACGIH TLV

Other Limits
Recommended

% (optional)

THERE ARE NO INGREDIENTS IN ALCONOX WHICH APPEARED ON THE
OSHA STANDARD 29 CFR 1910 SUBPART Z.

Section III — Physical/Chemical Characteristics

Boiling Point

N.A.

Specific Gravity (H₂O = 1)

N.A.

Vapor Pressure (mm Hg)

N.A.

Melting Point

N.A.

Vapor Density (AIR = 1)

N.A.

Evaporation Rate

(Butyl Acetate = 1)

N.A.

Solubility in Water

APPRECIABLE (GREATER THAN 10 PER CENT)

Appearance and Odor

WHITE POWDER INTERSPERED WITH CREAM COLORED FLAKES - ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used)

NONE

Flammable Limits

UEL

N.A.

UEL

N.A.

Extinguishing Media

WATER, CO₂, DRY CHEMICAL, FOAM, SAND/EARTH

Special Fire Fighting Procedures

FOR FIRES INVOLVING THIS MATERIAL DO NOT ENTER WITHOUT

PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS

Unusual Fire and Explosion Hazards

NONE

Stability	Unstable	Corrosions to Avoid	NONE
	Stable	XX	

Incompatibility (Materials to Avoid)

AVOID STRONG ACIDS

Hazardous Decomposition or Byproducts

MAY RELEASE CO₂ GAS ON BURNING

Hazardous Polymerization	May Occur	Conditions to Avoid	2
	Will Not Occur	XX	NONE

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? YES Skin? NO Ingestion? YES

Health Hazards (Acute and Chronic)

INHALATION OF POWDER MAY PROVE LOCALLY IRRITATING TO MUCOUS MEMBRANES. INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA.

Carcinogenicity: NTP? NO IARC Monographs? NO OSHA Regulated? NO

Signs and Symptoms of Exposure

EXPOSURE MAY IRRITATE MUCOUS MEMBRANES. MAY CAUSE SNEEZING.

Medical Conditions

Generally Aggravated by Exposure RESPIRATORY CONDITIONS MAY BE AGGRAVATED BY POWDER

Emergency and First Aid Procedures

EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES SKIN-FLUSH WITH PLENTY OF WATER INGESTION-DRINK LARGE QUANTITIES OF WATER, GET MEDICAL ATTENTION FOR DISCOMFORT

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material is Released or Spilled

MATERIAL FOAMS PROFUSELY. SHOVEL AND RECOVER AS MUCH AS POSSIBLE. RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADABLE.

Waste Disposal Method

SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE DISPOSED OF ACCORDING TO LOCAL REQUIREMENTS FOR NON-HAZARDOUS DETERGENT.

Precautions to Be Taken in Handling and Storing

STORE IN A DRY AREA TO PREVENT CAKING.

Other Precautions

NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL.

Section VIII — Control Measures

Respiratory Protection (Specify Type)

DUST MASK

Ventilation	Local Exhaust	Special
	NORMAL	N.A.
	Mechanical (General)	Other
	N.A.	N.A.

Protective Gloves

USEFUL-NOT REQUIRED

Eye Protection

USEFUL-NOT REQUIRED

Other Protective Clothing or Equipment

NOT REQUIRED

Work/Hygienic Practices

NO SPECIAL PRACTICES REQUIRED